Food and Agriculture Organization of the United Nations

Impact of the Ebola virus disease outbreak on market chains and trade of agricultural products **in West Africa**

Impact of the Ebola virus disease outbreak on market chains and trade of agricultural products **in West Africa**

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Dakar, 2016

The conclusions given in this information product are considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project. In particular, the recommendations included in this information product were valid at the time they were written, during the FAO workshop on the market chains and trade of agricultural products in the context of the Ebola virus disease outbreak in West Africa, organized in December 2014 in Dakar, Senegal.

The views expressed in this information product are those of the authors and do not necessarily reflect the views or policies of FAO.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

ISBN 978-92-5-109223-1

Cover photo credits: ©FAO/John Monibah, ©FAO/Julien Gavelle, ©FAO/Jesse Bonwitt

Contents

Foreword

In 2014, the West Africa region was confronted with the worst Ebola Virus Disease (EVD) outbreak ever observed in Africa, causing tragic loss of life, impacting country economies and adversely impacting agriculture as well as food and nutrition security in the region. Governments, institutions and infrastructures struggled to cope with the enormous challenges brought by the epidemic while the way of life of affected populations hung in the balance.

While the EVD outbreak is being contained over time, it is important to document lessons learned from this epidemic, given that such epidemics will very likely increase in frequency and gravity in the future. What did we missand which lessons did we fail to learn from previous outbreaks of Highly Pathogenic Avian influenza, SARS, MERS-Cov and other pathogens, that may have helped mitigate the dramatic situation we observed in West Africa? What systems should be put in place at local, regional and international levels to help anticipate and mitigate the risk of future outbreaks including on the agricultural and food security sectors?

The impact of a major disease outbreak on food security and nutrition through reduced agricultural activities in countries already affected by chronic food insecurity and malnutrition is also rarely quantified or underestimated and represents a double burden for populations facing both critical health conditions and unsteady access to nutritious and diversified sources of food.

Countries and the international community alike therefore need to be better prepared for future outbreaks, which requires understanding the driving forces that lead to public health emergencies and carefully examining their impact through a multi-sectoral lens. This calls for a renewed integrated and holistic approach to risk management beyond the health sector, which embraces the complexity of such events and recognizes their impact on all segments of affected societies and economies.

The work presented here provides an innovative contribution to the research already published on Ebola. It uses a market chain approach and provides an in-depth analysis of enabling factors, as well as limitations and constraints that influenced the resilience and vulnerabilities of several market chains. It builds on a multi-disciplinary and multi-sectoral approach bringing together the expertise from various disciplines and follows consultations with a wide range of experts in food security, disaster risk reduction, animal health, public health, epidemiology and anthropology, as well as actors of the agricultural market chains sector from the affected countries. It highlights the need to develop synergies between a variety of sectors and stakeholders; informing and involving the communities in the response mechanism; strengthening international co-operation and interdisciplinary approaches; and making better use of science and innovative technological solutions to improve research efforts.

Finally, it paves the way to future studies that should be conducted to better understand the underlying causes of emerging infectious diseases such as Ebola, and explore the possibility of establishing trade corridors to keep food systems functioning and avoid the double burden caused by diseases and the drastic loss of income as well as access to nutritious food by vulnerable populations who depend on agriculture as a primary livelihood.

Vincent Martin

FAO Representative in Senegal
Head of REOWA West Africa/Sahel

Authors

This document was written by Arlène Alpha and Muriel Figuié (Cirad) under the coordination of the FAO Sub-Regional Resilience Team for West Africa/Sahel (REOWA).

Acknowledgments

This document has been reviewed by Vincent Martin, Patrick David and Oriane Turot from the FAO REOWA team, and by Cheikh Ly (FAO Regional Office for Africa) and Juan Lubroth (FAO Animal Production and Health Division).

The document also benefited from the contribution of Helen Roberts (APHA), Lindsay McCrickard (DAI), Jesse Bonwitt, Julien Gavelle and Philippe Kone (FAO consultants).

The authors would like to thank the persons interviewed *(see list in Annex 7)*, the experts who attended the technical consultation meeting organized in Dakar, Senegal, in December 2014 *(see list in Annex 8)* as well as their colleagues Philippe Bastide, Nicolas Bricas, Christian Fargeot, Joël Huat, Frédéric Lançon, Sébastien Lebel, Denis Loeillet, Jean-Yves Rey, Sylvain Rafflegeau, François Roger, Thierry Ruf (Cirad), Jean-Luc Bosio (IRC) and Patrice Levang (IRD).

©FAO/Jesse Bonwitt

Acronyms

ACF	Action Against Hunger
APHA	American Public Health Association
CDC	Centers for Disease Control and Prevention
CEDEAO	Economic Community of West African States
CFSAM	Crop and Food Security Assessment Mission
CILSS	Permanent Interstate Committee for Drought Control in the Sahel
Cirad	Agricultural Research Centre for International Development
CSAO	Sahel and West Africa Club
DRC	Democratic Republic of Congo
EBOV	Ebola virus
ECDC	European Centre for Disease Prevention and Control
EFSA	European Food Safety Authority
EVD	Ebola Virus Disease
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FEWS NET	Famine Early Warning Systems Network
FNG	Guinean Franc
FPFD	Fouta Djallon Farmers Federation
GDP	Gross Domestic Product
HIV/AIDS	Human Immunodeficiency Virus Infection/Acquired Immune Deficiency Syndrome
ICC	International Chamber of Commerce
ICCO	International Cocoa Organization
IGC	International Growth Centre
IHR	International Health Regulation
IIED	International Institute for Environment and Development
ILRAD	International Laboratory for Research on Animal Diseases
ILR	International Livestock Research Institute
IOM	International Organization for Migration
IPPC	International Plant Protection Convention
IRD	Research Institute for Development
MRU	Mano River Union

NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
RSP	Regional Support Programme
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
USAID	United States Agency for International Development
VAM	Vulnerability Analysis and Mapping
WAEMU	West African Economic and Monetary Union
WATH	West Africa Trade and Investment Hub
WCO	World Customs Organization
WCS	Wildlife Conservation Society
WFP	World Food Programme
WHO	World Health Organization
WTO	World Trade Organization
WWF	World Widlife Fund

Executive summary

The Ebola Virus Disease (EVD) outbreak in Guinea, Liberia and Sierra Leone was unprecedented in magnitude and caused a major public health and socioeconomic crisis beginning in 2014 that will have multiple and long lasting repercussions on rural societies throughout the West African region. In addition to the tragic human death toll, the epidemic has severely affected agricultural market chains in the three countries. Indeed, beyond the disease itself and its dramatic public health impact, the measures implemented to limit its propagation (e.g. movement restrictions on collective transport, closure of weekly markets and borders) have had a tremendous social and economic impact on local communities that depend on agriculture as their primary livelihood.

The proper functioning of market chains and the flow of agricultural products are key factors influencing food and nutrition security. Communities are increasingly dependent on markets and their correct functioning for their food and nutrition security as revealed by food security studies conducted in the three countries (WFP-CILSS-FEWS NET, 2010; WFP-Guinée, 2010; WFP-Liberia, 2010).

In order to have a better understanding of the mechanisms by which agriculture, food security and trade have been affected by the EVD outbreak, a market-chain approach has been adopted in this study. It complements the FAO-WFP Rapid assessments and Crop and Food Security assessments (CFSAM) carried out between August and November 2014. Conclusions and recommendations are based on a literature review, thirty interviews with experts and market-chain actors, and a technical consultation meeting organized by FAO, with the support of Cirad in Dakar on 9-10 December 2014.

This study is the first attempt to use an innovative regional multi-stakeholder and participatory approach since the beginning of the epidemic, and was undertaken with a view to put into perspective the evolution of the disease in a broader agricultural and rural context. This approach has proven particularly relevant and useful to coherently organize different sets of information on production, trade flows, restriction measures, markets and consumer behaviours as well as to identify targeted interventions and mitigation measures. The strategies and measures adopted by different maket chain stakeholders to mitigate the difficulties they faced as a result of the EVD outbreak have also been considered in this study and were taken into account when drafting the recommendations in section four.

Seven market chains were selected for this study based on their importance to regional food security, the risks associated with Ebola and the extent to which they were disrupted by the outbreak. The market chains included rice, potatoes (as an example of horticultural products), cassava, palm oil, domestic animal products, bushmeat and cocoa in Guinea, Sierra Leone and Liberia.

The assessment shows that the EVD outbreak has disrupted the functioning of several cross-border agricultural market chains. Above all, it had a major negative impact on collecting and transporting agricultural production to consumption areas. This disruption stems from collectors[1] reluctance to travel to contaminated zones (the number of traders decreased by 20 percent at the peak of the outbreak according to WFP) and, to a lesser extent, to transportation difficulties arising from Ebola checkpoints, quarantine zones and the closure of certain borders.

These obstacles also contributed to reduced farmers' incomes (higher costs of inputs and lower negotiating power with collectors whose numbers decreased) and to instability of crop prices from geographical and seasonal normal patterns, thus establishing an atmosphere of instability and uncertainty for both producers and consumers within these chains. Consumer price increases were limited due to the low purchasing power of an already poor population, which was further weakened by the global economic slowdown. Some reductions in crop prices were observed, including potatoes in Guinea which

1 Buyers of agricultural commodities from local producers

are usually exported to Senegal (made impossible by the Senegal-Guinea border closure) and rice in the Kambia region of Sierra Leone (which normally exports to Guinea).

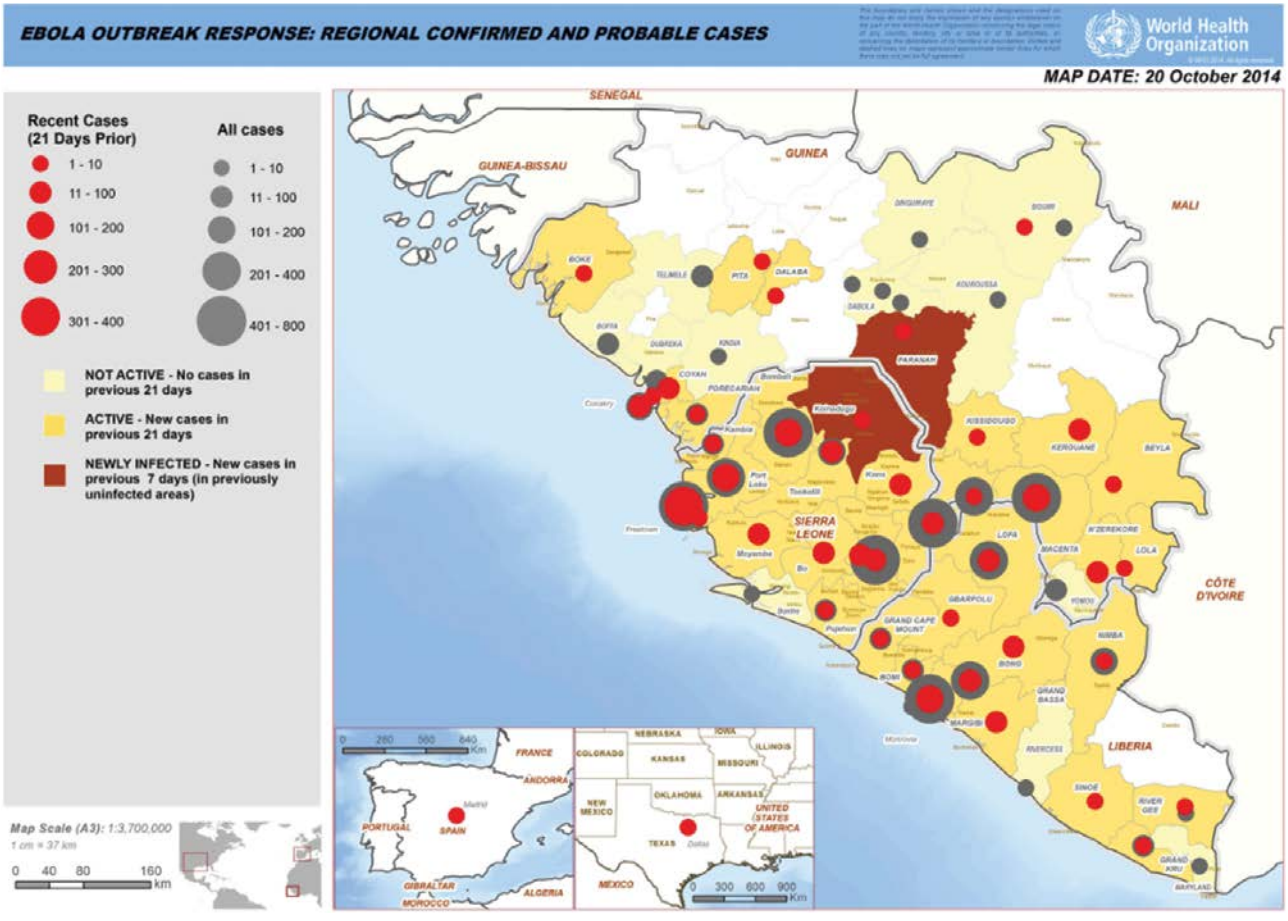
Some market chains were more resilient and absorbed the shock of the crisis better than others. These market chains were thus more efficient in contributing, directly or indirectly, to food access for the most vulnerable households. In this regard, the EVD epidemic represents a unique opportunity to expand the concept of resilience to a market chain system and identify the underlying causes of its resilience or greater vulnerability in the context of a systemic crisis.

For example, faced with the absence of collectors, better organized producers were able to market their products themselves in consumption zones. With the closure of local markets, some sellers opted to become street vendors. The consumption of imported rice partly decreased in favour of local tubers, and bushmeat in favour of fish or meat from domesticated animals. New regional trade routes were used: through Mali to bypass the closure of the Senegal-Guinea border or coastal navigation to bypass the re-routing of shipping lanes. Thanks to their financial capacity, social networks and, more generally, their speculative capacity, some stakeholders were able to benefit from increased price differentials between production zones affected by the epidemic and consumption zones.

However, other economic stakeholders within these market chains, mostly without storage capacities and with weak negotiating power, were more severely hit by restrictions. The most affected were stakeholders within long market chains (cocoa versus cassava), more labour- and input-intensive chains (poultry versus fish or cassava), chains with weak market diversification (cocoa versus palm oil), chains involving perishable products (potato versus cassava) and chains employing salaried labour (industrial cocoa versus rice).

This study also puts a special emphasis on the local rice market chain since local rice is essential to the region's food security. It is also emblematic of the epidemic's impact on agricultural market chains, both upstream and downstream. Production was

Map 1. Ebola outbreak : regional confirmed and probable cases as of 20 October 2014



Source: World Health Organization (WHO)

disrupted by illness, bans on gatherings, restrictions on the movement of people and the workers' fear of going to their fields because of Ebola. These factors especially affected group farm work. Domestic trade flows that normally go from rice production areas, particularly hit by the epidemic, to consumption areas were disrupted by restrictions on people's movement and goods within the three countries. At the regional level, stakeholders in Sierra Leone's local rice market chain also faced difficulties exporting parboiled rice to Guinea. Rice imports, which were not significantly affected by the epidemic, were able to make up the deficit in local production, but this came with the disadvantage of increasing the three countries' import dependence and national expenditure on food.

The bushmeat market chain is also considered key in this crisis since it could be the source of spillover events. Even if such spillovers can be viewed as rare events, their consequences are nonetheless disastrous. This sector represents an important safety net from a nutritional and economic as well as cultural point of view, and a means of controlling pests that damage crops. The EVD outbreak has affected the bushmeat market chain, but it is likely that apart from a lasting effect on the consumption of certain species (bats, non-human primates) and animals found dead, stakeholders will return to their previous activity. The ban on poaching which was hurriedly implemented during the crisis was costly and had limited effect. It is thus essential that the broader scientific community reflect on realistic and proportionate measures to establish during such an epidemic using an intersectoral approach that takes into consideration the market chain's environmental, health, food, economic and cultural aspects.

While the EVD outbreak is being contained over time, it is important to document lessons learned from this epidemic, given that such epidemics will very likely increase in frequency and gravity in the future. Like many other emerging infectious diseases, Ebola poses a systemic risk. Using OECD terminology (OECD, 2003), this is a risk that affects the systems on which society depends (health, transport, environment, telecommunications) and requires a systemic response, which is a new policy approach to risk management that includes developing synergies between public and private sectors; informing and involving stakeholders and the general public; strengthening international co-operation and interdisciplinary approaches; and making better use of science and innovative technological solutions to improve research efforts.

The severity of the EVD outbreak in Guinea, Sierra Leone and Liberia is due in large part to increased movement of goods and people within the region and illustrates how intensly and rapidly a virus of this kind can spread in a globalized, interconnected world. Chain effects highlight the increasing interdependence of geographic and economic spaces. These spaces can no longer close themselves off to ensure their own security because isolation tends to make them more fragile. The challenge in such circumstances is therefore to isolate the disease without isolating, and thus rendering fragile, what one seeks to protect. This is a growing problem in a globalized world, leading us to rethink the coordination of an increasingly vast network of actors. At the same time, this challenge also offers new opportunities to develop new forms of solidarity.

1. Introduction

By 21 January 2015, the Ebola virus disease (EVD) outbreak in West Africa had led to over 21 600 reported cases, including more than 8 600 deaths. Sierra Leone is the worst affected country with 10 300 cases (compared with 8 400 cases and 2 800 cases respectively in Liberia and Guinea, the two other worst affected countries in the region) but has reported fewer deaths than Liberia (WHO, 2015). Case incidence is now declining in all three countries, although the outbreak's evolution is still uncertain until the disease has been completely eradicated. In addition, it is likely that there is under-reporting in some areas with poor and overstretched healthcare services.

This unprecedented EVD epidemic is far more severe than the previous twenty-four outbreaks reported since 1976 mainly in Congo, Democratic Republic of Congo, Uganda and Sudan, and is having a dramatic impact on West African countries, especially Guinea, Liberia and Sierra Leone. The impact is even more worrying given that these three countries were gradually recovering from years of civil war and political upheaval and had been showing signs of economic recovery, especially Sierra Leone and Liberia (UNECA, 2014), (Bank, 2014c). The epidemic is also taking place in contexts of mass poverty, poor health infrastructure and fragile states, which explains its exceptional gravity and magnitude (UNDP, 2015).

Although the EVD outbreak is primarily a health crisis, the disease has led to various economic and social disruptions in the most affected countries and neighbouring countries. The reactions of fear caused by the outbreak and the restrictions on gatherings and movements of goods and people had repercussions beyond the direct impact on health[2]. Behavioural effects – related to the way risks are perceived and handled – can often be more significant from a socio-economic viewpoint than the effects of sickness and mortality themselves. Similarly, the policy responses implemented to contain the outbreak and protect public health may have perverse effects on other activities (e.g. trade and economics) and lead to higher indirect impacts than the disease itself. A number of EVD impact studies thus focus on the disease's socio-economic impacts rather than merely the public health consequences.

In particular, the EVD outbreak has strongly disrupted agricultural market chains within countries and across borders. Many different measures – qualified hereafter as *"restriction measures"* – have been established by public authorities and/or community leaders (self-organized control) to limit the propagation of the epidemic: closure of weekly markets, closure of borders[3], Ebola checkpoints on the main roads to/from counties, districts or villages to control entries and exits by screening people for Ebola symptoms. These measures vary from one country to another (e.g. two compulsory days at home in Sierra Leone or curfew in Liberia) and change rapidly (e.g. temporary closure of markets). However, they all cause disruption in agricultural products market chains and trade, with potentially significant impacts on those who depend on them for their livelihoods and food and nutrition security. This is of particular concern because chronic food insecurity is already a major issue in the three countries and there is a risk that the epidemic could have long-lasting, negative effects on food security.

There is therefore a need to assess and understand Ebola's impacts on market chains and food security while continuing to address the health problem by preventing human-to-human transmission. Ebola Response should be addressed through multisectoral policy: public health policy is a priority but this must be linked to other policies such as agriculture, economic, and food policies.

To document the impact of these disruptions and draft mitigation measures, FAO has conducted a number of studies with national authorities in the

2 In the rest of the document, the "EVD outbreak" refers to the epidemiological context as a whole, including health, economic, social and political dimensions.

3 Excepting Mali, the neighbouring countries of the three most affected countries had temporarily sealed their borders, but the porosity of borders remained an issue (World Bank, 2014b), (UNDP, 2015).

three most affected countries (Guinea, Sierra Leone and Liberia): rapid assessments of the food security situation in the context of the Ebola outbreak, crop and food security assessments (CFSAM) in collaboration with WFP, a rapid qualitative risk assessment for agricultural products in Ebola-affected countries, a rapid qualitative risk assessment for meat from wild animals and related activities linked to the Zaire Ebola virus (EBOV) in human populations and a bushmeat value chain analysis in the EVD outbreak context.

In addition, with technical assistance from Cirad, FAO has conducted an assessment of how market chains of agricultural products essential for local livelihoods (rice, horticultural products, cassava, palm oil, domestic animal products and cocoa) were affected by the EVD outbreak in 2014. This assessment is based on secondary data, interviews and the outcomes of a technical consultation meeting (Dakar, 9-10 December 2014). This report presents the conclusions of the assessment and makes recommendations based on the findings.

Using the outcomes of the technical consultation meeting and building on past studies conducted by FAO and others, the report presents an analysis of the impact of the EVD outbreak on selected market chains and some recommendations for restoring trade flows and ensuring the smooth functioning of markets while minimizing the risk of disease spread. After the description of the methodology used for the analysis in section two, section three presents a detailed analysis for each market chain. Section four presents recommendations, and concluding remarks are made in section five. Additional information can be found in the annexes.

©FAO/Julien Gavelle

2. Methodology

Many studies have now been conducted on the socio-economic impacts of the EVD outbreak, including on markets and food security. The different methodologies used, the specific angles addressed, the rapid evolution of data (a characteristic of any crisis) and their occasional contradictions make it difficult to have a clear overview of EVD-related impacts. The market-chain approach adopted in this document was jointly developed by FAO and Cirad based on the multidisciplinary market chain analysis approaches developed in Asia to understand the risk of the spread of infectious diseases such as Avian Influenza and to define control interventions at critical control points along market chains. It is an attempt to provide a detailed description of the impact of the EVD outbreak at the different stages of market chains.

2.1 A market-chain approach

The proper functioning of market chains and flow of agricultural products are key elements for food and nutrition security. Communities are increasingly dependent on markets and their correct functioning for their food and nutrition security as revealed by several food security studies conducted in the three countries (WFP-CILSS-FEWS NET, 2010; WFP-Guinée, 2010; WFP-Liberia, 2010).

In order to have a better understanding of the mechanisms by which agricultural market chains and trade have been affected by the EVD outbreak, a market-chain approach has been used. This approach proves particularly relevant and useful to coherently organize different sets of information on production, trade flows, restriction measures, markets and consumer behaviours. The strategies developed by different stakeholders in the market chains to mitigate the difficulties they face with the EVD outbreak are also considered in this market-chain approach. The recommended response options to address the various bottlenecks along market chains are based, in part, on the adaptation strategies reported from the field.

Seven market chains were selected based on their importance to regional food security, the risks associated with Ebola and the extent to which they were disrupted by the outbreak: rice, potatoes (as an example of horticultural products), cassava, palm oil, domestic animal products, bushmeat and cocoa.

For each market chain, we consider the impact of the entire epidemiological context, which refers to three main elements: the disease itself (and its impact on health), the different restriction measures and people's reactions to the epidemic (inhabitants who flee the affected areas, disruption of community dynamics, or farmers, wage workers, consumers, transporters, traders, investors, etc. ceasing their activities because of fear). Most of the EVD outbreak studies to date distinguish between the outbreak's direct and indirect impacts on the socio-economic variables under consideration, and recognize that indirect pathways are mostly responsible for these socio-economic impacts (WFP, 2014e)[4]. However, the factors classified as direct or indirect vary from one study to another. For instance, the World Bank (2014b) distinguishes firstly *"the direct and indirect effects of the sickness and mortality themselves, which consume healthcare resources and subtract people (…) from the labour force"*; and secondly the behavioural effects resulting from the fear of contagion that could motivate public actors or investors to take restriction measures. In a WFP document (2014e), indirect impacts are those stemming from official authorities' restriction measures (closure of borders and markets, restriction of movements, etc.) and behavioural changes (fear, panic, rumour, etc.).

The impact of the entire epidemiological context has been analysed for each stage of the agricultural market chains. These market chains have been disrupted at the production stage, e.g EVD incidence in Sierra Leone and Liberia is highest in these countries' main cereal-producing areas. In 2014, farming activities were affected by a lack of manpower (many farming households were affected by the disease or quarantined and labour availability was disrupted by public

4 As highlighted in the FAO-WFP CFSAM, "quantitatively, the direct impact in terms of the number people infected in relation to the size of the population of the area is very small".

bans or self-imposed restrictions on group work). Downstream from production, market chains were disrupted by restrictions on the movement of goods and people as well as changes in demand (lack of purchasing power, shifts in consumption, etc.).

Baseline information describing agricultural market chains before the outbreak has been gathered whenever possible to compare it with the situation during the outbreak. Lessons learned from past experiences with restriction measures have also been considered. Although most of the restriction measures are specific to the EVD outbreak (e.g. Ebola checkpoints to quarantine affected areas), some of them, such as the closure of borders, have already been implemented for non-health reasons. For example, bans on agricultural exports were used in Guinea in 2007 to contain the rise of food prices on domestic markets. These measures proved to be inefficient and may have counterproductive effects by encouraging market chain actors to bypass export bans, and lead to illegal flows and speculation. Moreover, gains for consumers are only short term as producers facing low selling prices are discouraged from producing and prices return to normal or even higher levels the following season.

However, it remains difficult to attribute clearly to the EVD outbreak any change at a given stage of the market chain. This is a well-known methodological limitation of any impact analysis, added to which is the difficulty of collecting and interpreting data (especially prices) in a context that is changing rapidly because of the EVD outbreak.

2.2 Data collection

The present document is partly based on an extensive review of the literature covering impact studies of the EVD outbreak as well as food and nutrition security and market chain studies. One of the difficulties when using secondary data is that methodological specifications are not systematically provided in the studies: for example, information about price types (producer or consumer prices), dates and locations of data collection, comparisons with previous years' averages, etc. are sometimes missing. In particular, price variations during the Ebola outbreak need to be assessed against previous price patterns; this has not been always the case.

There are also gaps in data collection, especially at the household level (e.g. changes in food consumption habits and expenditure on food items) because of the risks associated with conducting surveys at the peak of the outbreak. Lastly, collecting updated information on the different restrictions measures implemented in affected and non-affected countries has been difficult, especially through desk research. As noted by FEWS NET (2014a), these measures change frequently and precise information about the areas affected at a given time is limited. As a result, the information available is often contradictory.

The literature review was supplemented by thirty interviews with stakeholders of selected market chains, researchers and experts in agricultural market chains and trade in West Africa *(see list of interviewed persons in Annex 7)*. The technical consultation meeting organized in December 2014 in Dakar brought together around 50 stakeholders and specialists in food security, trade and agricultural market chains, experts in animal health, anthropology, epidemiology, public health and health risks, as well as private sector actors *(see presentation of the meeting and the list of participants in Annex 8).*

2.3 Price interpretation

At the beginning of the crisis, increasing prices were regarded as an indicator of economic disruption and a threat to household food security. A rising price indicator may reflect supply deficits due to lower production (labour shortage, shortage of inputs in affected and production areas), lower food imports (lack of public resources) or increasing demand due, for example, to the stockpilling of strategic stocks by households or other stakeholders. However, price increases as an indicator may be misleading for different reasons.

Price variations must be interpreted in the context of seasonal and geographical patterns. In the affected countries, during a *"normal"* year, prices vary greatly across time (post-harvest season, lean season) and space (areas of production versus consumption). Moreover, in addition to these structural factors, other factors, independent of the Ebola outbreak, may affect agricultural prices such as climate conditions. On this last point, however, the three countries normally enjoy abundant and regular rainfall and do not suffer from drought like countries in the neighboring Sahel region. Weather conditions were within normal range in 2014, aside from some heavy rains in the north of Sierra Leone in early September 2014.

3. Market chains

©FAO/Jesse Bonwitt

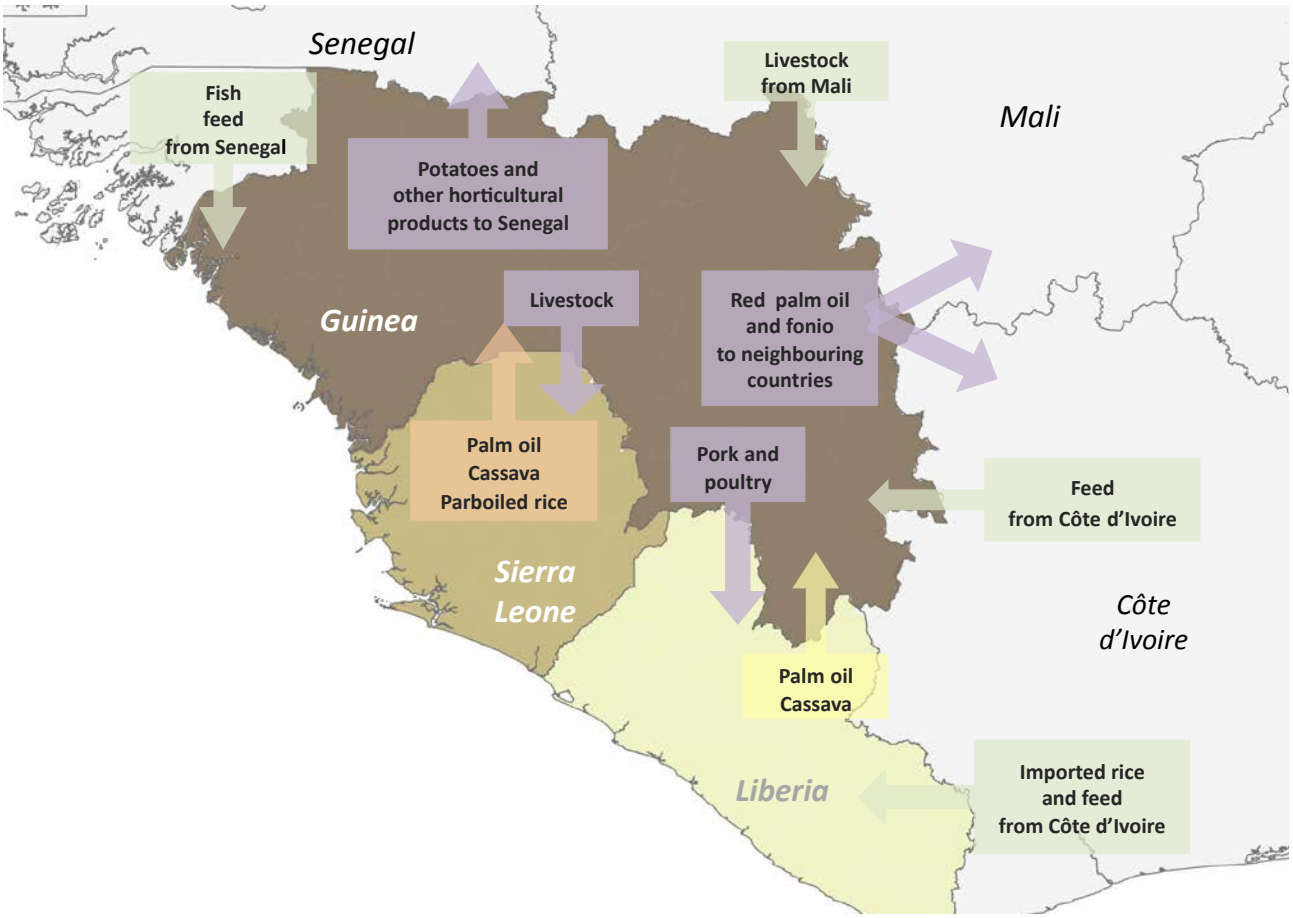
Introduction

This section presents the analysis of the impact of the EVD outbreak for each of the seven selected market chains: rice, cassava, potatoes (as an example of horticultural products), palm oil, domestic animal products, bushmeat and cocoa. As mentioned in the methodology section, these market chains were selected based on their importance to regional food security, the risks associated with Ebola and the extent to which they were disrupted by the outbreak itself. Attention was also given to their significance for regional trade *(see Table 1).*

Table 1. Main regional trade flows of agricultural products

From: / To:	Guinea	Sierra Leone	Liberia	Others
Guinea		Palm oil Cassava Parboiled rice	Palm oil cassava	Livestock from Mali Fish from Senegal Feed from Senegal and Côte d'Ivoire
Sierra Leone	Livestock		Re-exports of imported rice Livestock (seasonal)	
Liberia	Pork and poultry			Imported rice from Côte d'Ivoire Feed from Côte d'Ivoire
others	Potatoes and other horticultural products to Senegal Red palm oil and fonio to neighbouring countries			

Map 2. Main regional trade flows of agricultural products



Source : FAO

3.1 Rice[5]

Highlights

- Local rice production was affected by the EVD outbreak due to the difficulty of maintaining farmer groups for farm work but the decrease in production was contained at the national level (between four and 12 percent), with some regional disparities.
- The domestic and regional marketing of local rice was disrupted owing to traders' fears of colleting rice in affected areas, and by market and border closures.
- Impacts on prices varied considerably depending on the area and the type of price. No massive, generalized price hikes were observed but slight increases or decreases were reported, especially in producer prices.
- It is recommended that farmers are encouraged to resume farmer group activity and that measures are taken to reopen key periodic markets including a series of health measures to reduce risk (communication, hygiene kits, cleaning of infrastructure, etc.).

Rice is of significant socio-economic importance in the three affected countries; it plays a determining role for food security and represents a significant share of economic activity (marketing, processing, transport, importation, etc.). Rice is the main staple in the three countries but the level of local rice production and the types of rice consumed are different. In all three countries, rice production is based largely on a labour-intensive, rain-fed system requiring villagers' collective work for certain crucial production stages (sowing, maintenance, harvest, etc.)

Imported rice is strongly present in all three countries, even Guinea, which is one of the largest rice producing countries in West Africa. Over the 2009-2013 period, more than 1.7 million tonnes of paddy rice on average were produced annually in Guinea, covering around 80 percent of domestic consumption, while the remaining 20 percent (around 250 000 tonnes of rice - milled equivalent) was imported to supplement local production (FAOSTAT 2014); (ATP, 2012); (UNDP, 2014). 'Country rice' (a parboiled rice made from locally-produced paddy) is more expensive than imported rice (white rice) but preferred by Guineans (ATP, 2012)[6]. In Liberia, imported rice is by far the most consumed rice with around two-thirds of domestic needs covered by rice imports (WFP-Liberia, 2010); (WFP-Liberia, 2011)[7]. Import dependency is far lower in Sierra Leone where local production of paddy rice has increased significantly over recent years, accounting for over one million tonnes per year on average over the last five years (FAOSTAT). Rice imports are mainly from the international market but regional trade flows are not negligible. Sierra Leone in particular exports substantial quantities of local parboiled rice to Guinea.

The local and imported rice market chains have very different socio-economic characteristics: the local market chain provides a livelihood for millions of small-scale farmers and other actors[8] whereas the imported rice market chain is highly concentrated[9] and provides accessible rice for millions of consumers. Therefore, any disruption in rice production and (both local and international) trade flows due to the EVD crisis may have negative impacts on food security and the socio-economic situation in general.

The EVD outbreak's impact on the rice market chain is related to production and trade disruption and not to the product itself. The rapid qualitative risk assessment *(see Annex 2)* concludes that imported rice has a negligible risk (i.e. so rare it can be excluded) of being contaminated with Ebola. For local rice, the risk to human health through contamination of the

5 Thanks to Frédéric Lançon (Cirad) for his contribution

6 According to ATP (2012) country rice is sold at around a 50 percent mark-up with respect to imported rice.

7 Production of paddy rice in Liberia was less than 300 000 tonnes per year on average over the 2009-2013 period and imports of milled rice equivalent were around 200 000 tonnes per year on average over the 2006-2011 period (FAOSTAT).

8 408 000 farming households in Liberia (WFP-Liberia, 2010).

9 A handful of companies (mainly Lebanese traders) control the rice import business: only seven companies are involved in importing rice in Liberia, with one of them accounting for 70 percent of total rice imports (WFP-Liberia, 2010); six firms are said to account for 90 percent of rice imports in Sierra Leone (WFP-CILSS-FEWS NET, 2010).

Table 2. Figures of rice production decreases due to EVD

	Impact of EVD on rice production Decrease in % compared with estimates without EVD
	Rice
Liberia	11.6%
County with highest impact: Lofa	20%
Sierra Leone	8%
County with highest impact: Kailahun	17%
Guinea	3.7%
County with highest impact: Nzerekore	8.4%

Source: FAO-WFP CFSAM for each country.

product after contact with an infected person, infected meat or contaminated equipment is also very low, particularly in comparison to the risk of contamination between market-chain actors.

Limited decline in national rice production despite labour shortages

As the 2014 rice-harvesting season progressed, crop production estimates were fine-tuned and the expected decline in production was revised and appears relatively limited (FAO-WFP CFSAM for each of the three countries).

Previous pessimistic forecasts for rice production were backed up by the fact that the rice producing areas in Guinea and Sierra Leone were also those most affected by the EVD outbreak. Forested Guinea is the main rice-producing area in Guinea (far ahead of Maritime Guinea[10], another major production area), and was also the starting point of the epidemic's spread in the country and beyond to Liberia and Sierra Leone. Sierra Leone's main rice-producing areas are Kalangba, Makeni and Pujehun, - Kalangba and Makeni were severely affected by EVD, although to a lesser extent than Kailahun near Forested Guinea. In Liberia, the county of Lofa, the main food-production area, in the north west of the country near the Gueckédou prefecture – is also one of the areas most affected by the outbreak (World Bank, 2014a).

In addition, the outbreak erupted and spread at a crucial period for the rice-farming season *(see crop calendar, Annex 5)*, during the period normally dedicated to land preparation, crop maintenance (weeding, fencing, application of chemicals, etc.) and harvesting (FAO-WFP Rapid assessments, FAO-WFP CFSAM). For example, the Gueckédou prefecture reported that the outbreak began when land preparation was about to start (AGP, 2014). The outbreak peak of August and September 2014 occurred just before the harvest period in Guinea (FARM, 2014).

A decrease in rice production was therefore expected in 2014 compared with past farming seasons. At the start of the season, early estimations of rice production were relatively positive because of favourable weather conditions. Data collected through the FAO-WFP Rapid assessments and Crop and Food Security Assessment Missions (CFSAM) showed a slight decrease at the national level. The figures were nevertheless higher in rice-producing areas particularly affected by the EVD outbreak *(see Table 2)*. In Guinea, lower production was expected in 36 affected prefectures of the 47 surveyed (FAO-PAM-Guinée, 2014) and a reduction of 3.7 percent was estimated at the national level while an 8 percent decrease was estimated in N'Zérékoré (FAO-WFP-Guinea, 2014)[11]. The rapid assessment in Sierra Leone indicated that 60 percent of those interviewed expected a reduction compared with 2013 and the CFSAM estimation confirmed a reduction of 8 percent at the national level. In Liberia, rice production was expected to decrease, with estimations varying from ten to 15 percent in general and up to 25 percent in the worst affected districts (FAO-WFP-Liberia, 2014a), which is consistent with CFSAM's estimation of a 12 percent reduction (FAO & WFP, 2014c).

10 Forested Guinea produces 38 percent of the national rice production while Maritime Guinea counts for 27 percent of total production (WFP-Guinée, 2010).

11 The FAO-WFP CFSAM (2014) estimates the Guinean rice production (milled rice equivalent) to be 1.3 million tonnes in 2014, a decrease from 2013 levels.

The World Bank's update on the EVD outbreak's economic impact on the three most affected countries is in line with FAO-WFP figures: *"the impact on agriculture may not be as serious as earlier thought (…) government advice against congregating in large groups may have affected shared farm labour, reducing the size of groups from up to 50 to below ten people, with an estimated effect on the rice harvest of up to about 25 percent"* (Bank, 2014c). World Bank mobile phone surveys also showed that farm abandonment was not as widespread as previously feared and those who had abandoned farms were returning to their land to farm (Bank, 2014c).

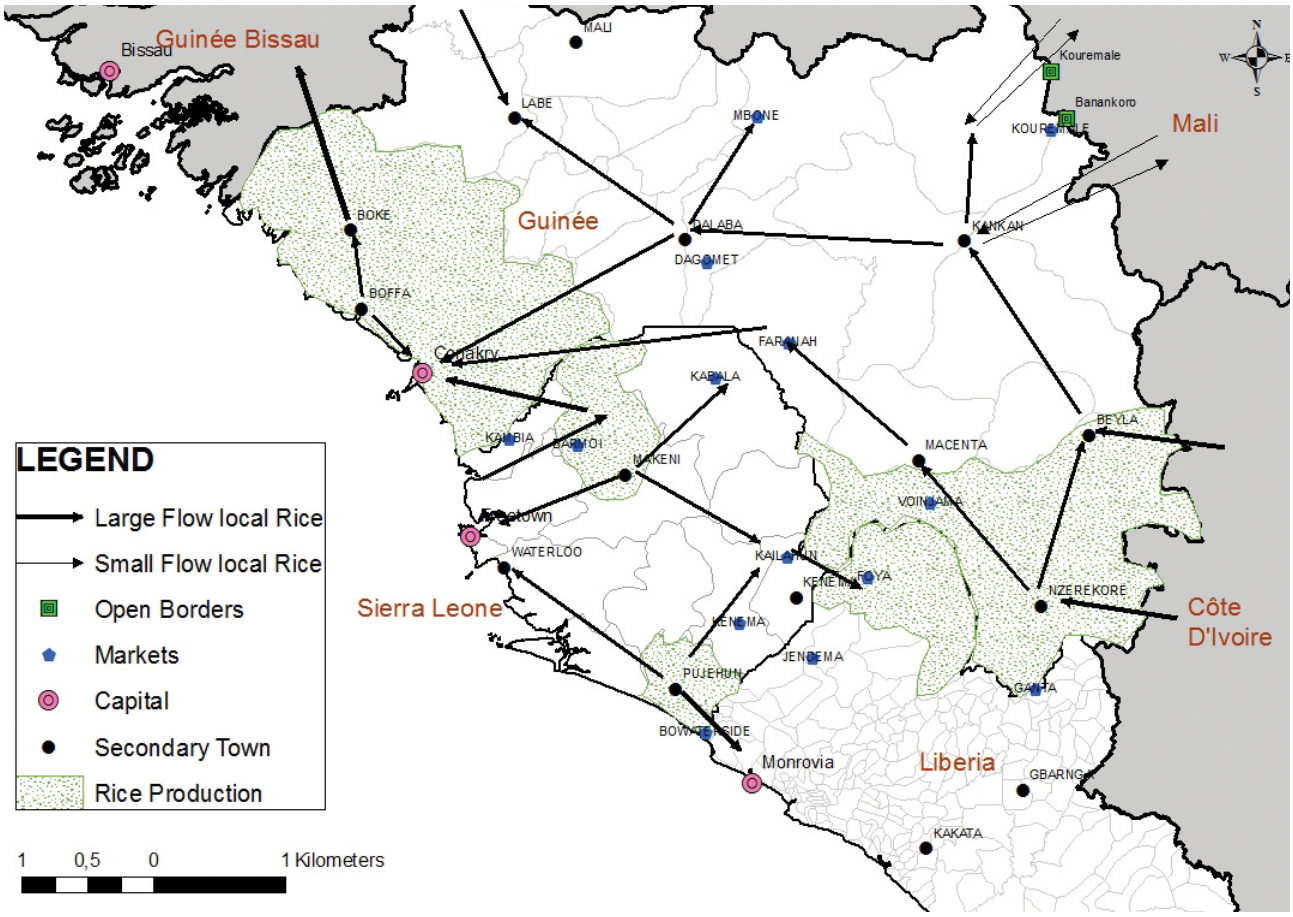
EVD's negative impact on rice production was mainly due to labour shortages. Fear of contamination and/or restrictions on gatherings affected collective farming activities in all three countries. The use of family labour instead of community teams hampered farm work and resulted in lower yields. In Gueckédou prefecture, farmers' migration to safer areas often prevented mutual-assistance groups from working (AGP, 2014). In Sierra Leone, farmers expressed fear of meeting or even sharing tools, and a result they missed some crucial stages in the planting season (World Bank, 2014a). In Liberia, the 'kuu system' was disrupted by quarantine measures and restriction on group work in the most affected counties (Bomi, Bong, Lofa and Margibi, Nimba). Almost all rapid assessment and key informants forecast a reduction in yields because of the limited maintenance of fields (weeding and fencing) though no problems were reported for rice planting this season (FAO-WFP-Liberia, 2014a).

The relatively limited decrease in rice production at the national level may be explained by the fact that the planting season was less strongly disrupted (FAO-WFP CFSAM). In Liberia, for instance, it was pointed out that the more labour-intensive land preparation and planting activities had already been completed through the 'kuu system' when the outbreak and public awareness reached a peak in August (FAO & WFP, 2014c). The use of family labour – while less efficient than mutual-assistance groups – also seems to be a key factor in mitigating the risk of a strong fall in production. As a result, the impact of EVD on the local rice market chain was mostly felt at the marketing level.

At the time this document was written, it remained uncertain what the outcome would be for the 2015 production. Since new cases of Ebola were decreasing, it was likely that the next season would be fairly favourable.

©FAO/Julien Gavelle

Map 3. Local rice trade flows *before* the EVD outbreak



Source: FAO, based on FEWS NET, CILSS & ACF (2013); WFP-Sierra Leone (2011); FEWS NET, CILSS & WFP (2010).

Marketing of local rice strongly disrupted

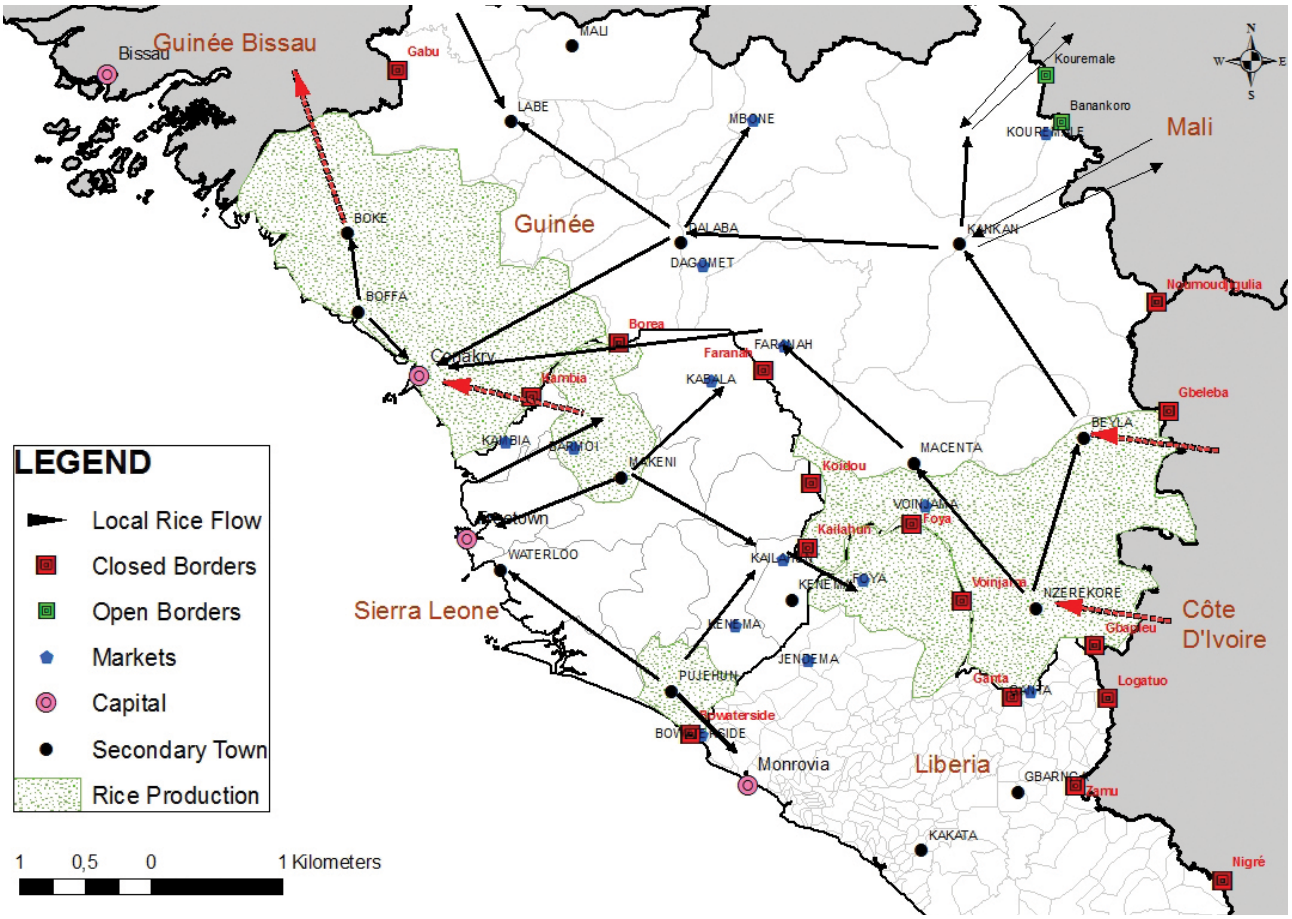
The impact on the local rice trade was due to traders' fears of collecting rice in Forested Guinea, restriction measures throughout the countries, and movement restrictions due to border controls at domestic and regional levels.

At the domestic level, the surpluses of rice produced in Forested Guinea are usually traded in urban markets in the region (N'Zérékoré, Macenta, Gueckédou) as well as outside the region in Labe, Kankan and Siguiri (Upper Guinea) and Conakry *(see Map 3)*. Much of the surplus rice is produced on the coast (Boffa, Forécariah) (ATP, 2012); (FAO-PAM-Guinée, 2014). In Sierra Leone *(see Map 3)*, domestic trade flows of local rice surpluses usually go from the producing areas (Kalangba, Pujehun and Makeni) to deficit regions in the north and urban centres (WFP-Sierra Leone CFSVA 2010).

At the regional level, trade flow volumes of rice are far lower than those of domestically-traded rice surpluses. However, there is an emerging regional market with exports of parboiled rice from Sierra Leone to Guinea *(see Map 3)*. Urbanization, rising prices since 2008 and a strong preference for local parboiled rice of the type produced in nearby Sierra Leone are driving an intensifying cross-border trade in this commodity (WFP-CILSS-FEWS NET, 2010). In particular, Guinean traders usually come to the large weekly market of Barmoi (Barmoi Luma International Market) in the district of Kambia to buy local rice and sell it in Guinea's capital Conakry (interview).

Since the outbreak, at the domestic level, it was observed that fewer collectors and wholesalers were entering EVD-affected areas in the Forested region in Guinea. The reduced number of collectors and wholesalers decreased the bargaining power of producers, who were forced to sell at lower prices than expected. In Sierra Leone, the restriction measures, especially on transport (reduced number of trucks entering and leaving certain districts of Sierra Leone) and marketplaces (closure of 'lumas' -weekly markets), inevitably affected normal trade flows *(see Map 4)*.

Map 4. Local rice trade flows *during* the EVD outbreak



Source: FAO, based on FEWS NET, CILSS & ACF (2013); WFP-Sierra Leone (2011); FEWS NET, CILSS & WFP (2010), FAO Technical Consultation Meeting.
Note: the dotted arrows represent regional trade flows disrupted by the border closure.

The Ebola-related measures of border closures between affected countries also disrupted regional trade dynamics *(see Map 4)*. According to the FAO rapid assessment in Sierra Leone, because of movement restrictions and market closures, rice producers and traders in Kambia and Port Loko districts faced physical constraints to reach markets in Guinea and Freetown. This resulted in the possible loss of contracts for producers as well as loss of income and reduced activity for most agribusinesses (FAO-Sierra Leone, 2014a).

There are also cross-border flows of imported rice *(see Map 5)*, especially when the exchange rate makes imports from neighbouring countries more profitable than from the international market. For example, due to poor road connections with Monrovia, trade flows of imported rice have been observed from Côte d'Ivoire to chronically food-insecure south eastern Liberia. The remote Pujehun district of south-eastern Sierra Leone also acquired imported rice from Liberia through the Bo-Waterside market (Grand Cape Mount county) because it was the cheapest source of imported rice. Imported rice re-exported from Guinea was found in the Liberian markets of Saclepea (Nimba county) and Gbarnga (Bong county) in late 2009, when the value of the Guinean franc against the Liberian dollar had eroded to the point of making such re-exports to Liberia profitable (WFP-CILSS-FEWS NET, 2010).

Initial concerns about volumes of imported rice in Liberia following the EVD outbreak (rerouting of shipping lanes, doubts over Liberia's financial capacity to buy an increasing volume of imported rice) had receded by early 2015. The Liberian government negotiated with importers to ensure sufficient volumes of imported rice but this capacity to mitigate the risk of Ebola impacts on rice availability proved costly (The Guardian, 26 Sept. 2014). During the EVD outbreak, concerns were raised that transporters (freighters, shippers) may decide that it was no longer worth the risk to work in Ebola-affected countries, but this never materialized as a critical issue. Had this been the case, some ports in the region could have prevented access to boats that had made a stopover in Conakry, Freetown or Monrovia, with imported rice transhipped on

coasters, thus increasing the cost of transport. If a transporter were to be infected with Ebola, the direct result would probably have been an immediate decrease in importation.

Slight increases (or decreases) in prices but no general price hikes

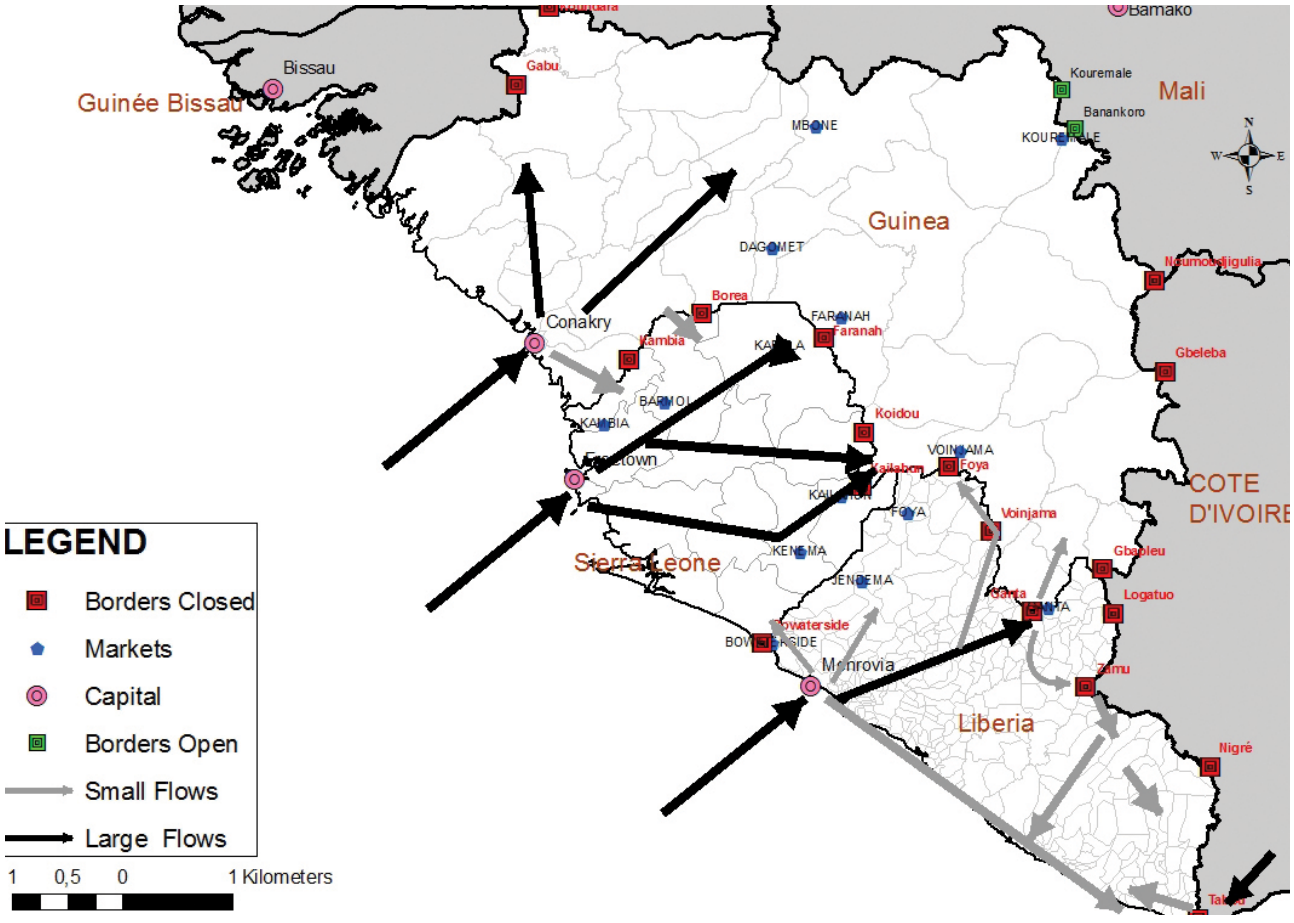
The impacts of the EVD outbreak on rice production and marketing activities because of fear and restriction measures affected the rice supply. Demand was also affected by the lack of customers at markets because of travel restrictions and decreasing purchasing power in all three countries. Both supply and demand elements had repercussions on rice price trends. However, other variables such as the type of rice (local/imported), price (producer/retail), area (severely/less affected by EVD, locally or externally supplied) and levels of traders' stocks also caused prices to vary considerably[12].

Areas that relied on external suppliers, sometimes suffered from inconsistent supply leading to an increase in prices. This was reported for the county of Bong in Liberia for instance, which was strongly affected by EVD and related restriction measures (FAO-WFP-Liberia, 2014a). In urban centres in Sierra Leone, the rapid assessment (FAO-Sierra Leone, 2014a) showed that the prices of most commodities including rice (wholesale price for rice bag and retail price for rice cup) increased. In Guinea, some areas not affected by EVD but relying on local rice from Forested Guinea (e.g. prefectures of Kissidougou, Kerouané, Forécariah) saw an increase in local rice prices when traders' stocks were not sufficient (FAO-PAM-Guinée, 2014).

However, decreases in local rice prices were observed in other Guinean areas, especially in the rice-producing region of Forested Guinea (e.g. prefectures of Macenta, Gueckédou, N'Zérékoré) – although very localized increases may have occurred within these areas due to the temporary market closures (FAO-PAM-Guinée, 2014). In N'Zérékoré for instance, the

12 It should be noted that price data are somewhat difficult to interpret because prices are highly volatile and previous years' averages are not systematically compared in the different studies (see the methodology section).

Map 5. Imported rice trade flows



Source: FAO, based on FEWS NET (2014b).

price of local rice was 32.3 percent lower than the average of the previous five years, while the price was 16.3 percent higher in Labé compared with the average of the previous five years.

In Sierra Leone, it was reported that owing to the closure of the large Kambia market (Barmoi Luma international market), local rice was no longer being exported to Guinea and its price had decreased. The local rice normally sold at 250 000 Leones for a 50kg bag and was currently being sold at 200 000 Leones (interview). Weak demand also led to drops in sales and falling local rice prices at farm-gate level. This issue was raised by the Kabala Women Vegetable Cooperatives Society (FAO-Sierra Leone, 2014a).

Similarly, in the county of Lofa in Liberia, where a large amount of rice is produced, the number of customers also decreased significantly(FAO-WFP-Liberia, 2014a). It was reported by the NGO Concern (2014) that fewer traders were coming to the Thursday market in Zorzor, and sales dropped as a result.

For imported rice, slight increases in prices were reported in some Ebola-affected areas[13]. This is the case of broken rice in Bomi county in Liberia (the largest market for imported broken rice) and imported parboiled rice, especially in Lofa county (FAO-WFP-Liberia, 2014a); (WFP, 2014c [sept]). Nevertheless, the price is generally not very high in Liberia and prices were stable for imported rice prices in Guinea. In Sierra Leone, IGC (2014a) noted that prices did not rise much compared with 2012 prices in all areas, suggesting that transport issues and traders' fear of infection did significantly disrupted the flow of imported rice to markets. The number of traders for imported rice is relatively constant between 2012 and 2014 in both EVD-affected districts and non-affected districts. The FAO rapid assessment in Sierra Leone confirmed the slight price increase for imported rice. It was specified that in normal times, farmers would have started early harvesting, which helps to reduce the price of imported rice on the market.

13 According to FAO-WFP-Liberia (2014a), these slight increases "can also partially be attributed to the depreciation of the exchange rate between the Liberian Dollar and the US Dollar".

©FAO/John Monibah

New areas faced with food insecurity vulnerability

Little information is available on food consumption changes due to the impact of EVD on food market chains and food prices.

However, in EVD-affected areas, incomes from the production and trade of local rice fell with the decrease in local rice prices (FAO-PAM-Guinée, 2014) and rice producers' and traders' livelihoods were affected. Consumers may have benefit from cheaper rice in some cases, e.g. when the fall in producer prices was passed on to retail prices. However, the scarcity of customers at markets and price increases for imported rice (and other basic commodities) suggest instead that they faced a significant drop in purchasing power.

The EVD outbreak affected rice-producing areas that are not usually among the most food insecure areas, apart from Forested Guinea. The N'Zérékoré area in Forested Guinea, which covers the Gueckédou prefecture where the outbreak originated, is one of Guinea's regions most affected by chronic food insecurity with over 50 percent of inhabitants being food insecure (WFP-Guinée, 2010). The region has turned to mining activities at the expense of agricultural production, making communities more dependent on the market for their food security (Ministry of Agriculture, 2014). WFP (2014e) shows that the worst-affected areas were relatively food secure prior to the EVD outbreak. By contrast, many of the areas less affected by EVD were highly food insecure before the crisis (WFP, 2014e). Therefore, the outbreak led to economic difficulties, and possibly food insecurity, for communities who are generally less vulnerable. These newly-vulnerable communities may be more resilient to the degradation of their livelihoods than chronically food insecure communities. Being wealthier, they may have more assets to mitigate the consequences of the EVD outbreak. However this needs to be confirmed by in-depth household food security surveys.

Some changes in consumption, such as substituting rice with other commodities, were observed as adaptation strategies due to decreasing purchasing power. Cassava is usually a substitute for rice in the three countries, although to a lesser extent in Liberia where cassava is associated with the lean season and rice demand is less closely linked to price increases (interviews). Concern (2014) notes that in Lofa county, Liberia, people were gradually diversifying their diets. For instance in Zogboyeata (Zorzor) cowpeas and plantains were being considered as an alternative to rice. In Guinea, particularly in Forested Guinea, the FAO-WFP rapid assessment concluded that the outbreak had led to growing food insecurity in EVD-affected areas: household food consumption had fallen for 90 percent of the communities surveyed in EVD-affected areas. The consumption of imported rice had fallen dramatically and in some non-rice producing regions, rice had been replaced by maize and tubers (FAO-PAM-Guinée, 2014).

Conclusions and recommendations

The impacts of EVD on local rice market chains were mainly due to the difficulty of maintaining farmers groups for farm work and marketing rice at domestic and regional levels. Two main recommendations have been made to address these difficulties:

- **Encourage farmers to resume labour groups' farming activities**
  In areas where EVD prevalence is high and collective work has been disrupted with negative consequences on production levels, a nationwide campaign built on simple but reassuring messages is recommended to encourage farmers to resume labour groups. Information campaigns should be complemented by increased access to rural hygiene kits (so far focused on urban areas) and the active participation of local actors (village chiefs, farmer leaders, etc.).

- **Accompany the re-opening of key periodic markets with health measures**
  It is recommended that key periodic markets should be re-opened, especially in districts where EVD transmission has drastically reduced or is showing signs of decreasing. This re-opening should rely on intensive communication activities and information for the different stakeholders using the marketplace as well as the distribution of hygiene kits. Moreover these marketplaces should be closed at night and disinfected once a week.

3.2 Potatoes (and other horticultural products)

Highlights

- The five-month Senegal border closure from August 2014 to January 2015 forced Guinean producers and traders to halt their exports of horticultural products to Senegal, leading to huge post-harvest losses.
- The EVD-related restriction measures led to a dramatic fall in producer prices in the Fouta Djallon (2000 GNF/kg in August 2014 instead of more than 3000 GNF/kg usually), a region that was not been severely affected by the epidemic.
- The main recommendation when borders must be closed for health reasons is to consider establishing trade corridors allowing for a minimum flow of agricultural goods and market-chain function.

The potato[14] market chain in Guinea is known as a very dynamic market chain promoted by the dynamic Federation of Producers of Fouta Djallon (FPFD). This market chain provides jobs and livelihoods for thousands of people, both in production and consumption areas in Guinea and abroad (e.g. Conakry, Freetown, Monrovia, Bissau and Dakar). The actors involved in the potato market chain include producers, agricultural workers, input traders, transporters, retailers and other service providers (FPFD Memorandum).

Around 20 000 tonnes of potatoes and several other thousand tonnes of fruits and vegetables (e.g. cabbages, carrots, tomatoes, eggplants) are produced each year in Mamou and Labe in Middle Guinea, around half of which are exported mainly to Senegal, and also to Gambia, Guinea-Bissau, Mali, Sierra Leone and Liberia.

The potato market chain and the FPFD have encountered significant difficulties in the past because of governmental decisions to close borders. In response to a general strike, the Guinean authorities decided in January 2007 to ban the exportation of certain food products (including potatoes) in order to exert downward pressure on food prices on domestic markets. Because the domestic market was not able to absorb production surpluses, this resulted in a dramatic drop in producer and retail prices, and significant post-harvest and financial losses for traders (because of poor storage conditions). In addition, the Federation suffered significant financial losses, estimated at around 4.4 billion FNG, due to the non-reimbursement of input loans and bank charges. While consumers benefited from cheaper potatoes in the short term, the difficulties faced by producers and the Federation had negative repercussions on subsequent farming seasons leading to an increase in the price of potatoes (Le Coz-Broutin, 2009).

This section focuses on the potato market chain in Guinea because it clearly illustrates the consequences of border closure on market chain dynamics. However, in Liberia and Sierra Leone, vegetable market chains have also been affected by restriction measures. In Liberia, most vegetable production for sale takes place in the counties most affected by the EVD outbreak (e.g. Lofa, Margibi, Bomi, Bong, and Nimba) as they are well-connected to Monrovia. Because of road blockades, sale prices dropped, resulting in loss of income (FAO-WFP-Liberia, 2014).

In Sierra Leone, vegetable producers were hard hit by restriction measures in Koinadugu district (northern region), especially by the drastic reduction in the number of trucks leaving the district (from ten to five) and the frequency of weekly transport (from 2-3 to 2), (FAO-Sierra Leone, 2014b). This led to spoilage of vegetables on the farm, post-harvest losses and lower prices for the small quantity of vegetables leaving the district. Representatives from the Kabala Women Vegetable Cooperatives Society reported that the Freetown market was no longer accessible, and this led farmers to sell their vegetables at the local market in Kabala town (FAO-Sierra Leone, 2014a). In local markets, more vegetables were available as consumers purchased less, leading to a glut in these markets, and farmers are therefore forced to sell at very low prices. Moreover, because production activ-

14 Potatoes considered here are the Solanumtuberosum variety.

ities were maintained at higher costs (seed inputs are more expensive), farmers faced a reduction in profitability. With this income loss, the risk was that fewer amounts of vegetables would be produced during the 2015 season (FAO-Sierra Leone, 2014b).

Guinean exports of potatoes to Senegal stopped by a five months border closure

On 26 January 2015, Senegal reopened its land border with Guinea after five months of closure[15]. On 3 September 2014, the government requested the closure of 16 weekly markets along its border with Guinea (WFP, 2014b), including the large regional market of Diaobé, the main market outlet for Guinean potato exports. The border closure between Guinea and the other EVD-affected countries is also an important element since traders from these countries (especially Sierra Leone) usually come to Guinea to purchase potatoes from producers in Fouta Djallon or from wholesalers in Conakry (Le Coz-Broutin, 2009) *(see Map 6)*.

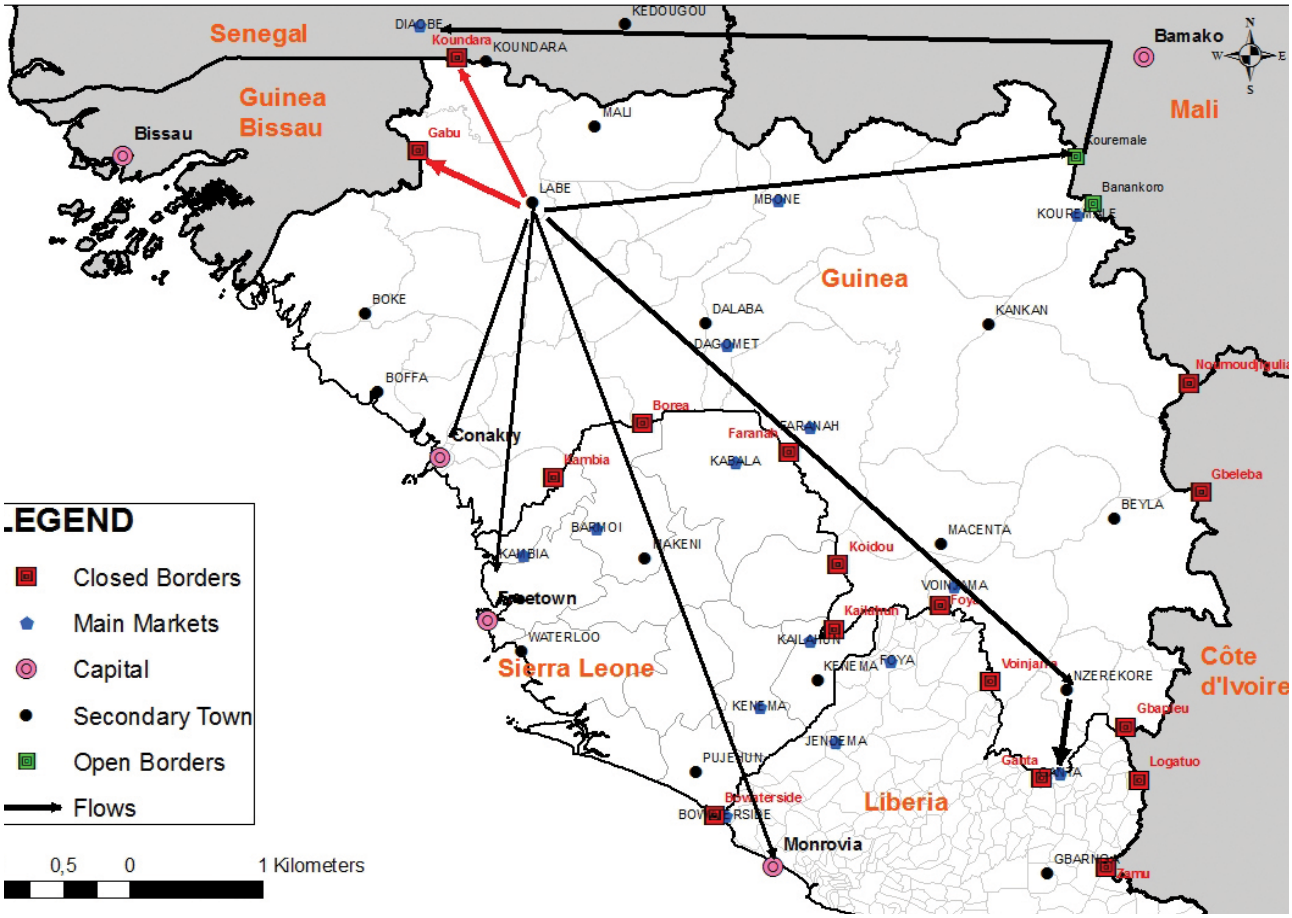
The perishable nature of potatoes is a strong constraint for market-chain function when restriction measures such as border closure are imposed. This situation is the same for other, even more perishable horticultural products, (e.g. cabbage) exported from Guinea, especially from the Fouta Djallon region. The impact of the EVD-related restriction measures on horticultural market chains in Fouta Djallon was therefore far from negligible, although this region was not severely affected by EVD and the risk of contamination through the product was negligible *(see the qualitative risk assessment in Annex 2)*.

Significant post-harvest losses

The difficulty for producers and traders to sell surpluses in neighbouring countries led to significant spoilage and post-harvest losses. The 2014 rainy season and inter-season were particularly favourable for production (estimated by the FPFD at 22 800

15 After a first closure of its land border from 30 March to 6 May 2014, Senegal decided to close its land border again on 21 August 2014. The recent re-opening of the land border was preceded by the re-opening of air and maritime borders on 14 November 2014.

Map 6. Potato trade flows during the Senegal border closure



Source: FAO, based on FAO Technical Consultation Meeting.

©FAO/René Ifono

tonnes). Exceptionally large areas were planted, but potatoes that reached maturity were left to rot in fields or filling warehouses and were lost due to poor storage conditions (FPFD memorandum).

Drop in producer and retail prices

A significant drop in both producer and retail prices was observed in the region of Fouta Djallon in August 2014 compared with the same period in 2013. According to the farmer federation, the average farm-gate price for potatoes did not exceed 2 000 GNF/kg in August and early September 2014, while in 2012 and 2013 August prices were 3 092 and 3 483 GNF respectively. Meanwhile, the local retail price for potatoes dropped by 65 percent between June and September 2014 on the market of Labé, a key market in this region on the Guinea-Senegal trade route (WFP, 2014c [sept]). Price decreases have also been reported in the Dalaba prefecture, especially in Dalaba and Pita (FAO-PAM-Guinée, 2014).

However, the FAO-WFP rapid assessment carried out in Guinea reported increases in potato prices compared with the period before the outbreak in some non-producing prefectures: Dabola, Kissidougou, Kouroussa, Guéckédou and Forécariah. These price increases were possibly due to lower supply from Maritime Guinea (FAO-WFP-Guinea 2014).

Lower incomes for farmers and potential financial losses

According to the FPFD, because farmers were forced to sell at a loss or discard their products, production costs were not covered (although production costs in the rainy season and inter-season are typically far lower than during the dry season[16]).

The decrease in farmers' incomes was likely to cause difficulties for loan repayments to purchase farm inputs for the following season and probably resulted in financial losses for the producer federations concerned and their members. Selling at a loss also limits farmers' ability to build food stocks and pay for education, health and schooling (FPFD memorandum). FPFD estimated post-harvest losses at around 45.6 billion GNF (USD 6.5 million) and UNDP (2014) estimated income losses of approximately 0.6 percent of GDP for all potato market chain actors.

16 Renewed seeds and fewer inputs are used and there is no irrigation (Le Coz-Broutin, 2009).

Conclusions and recommendations

The EVD-related restriction measures imposed by Senegal to avoid the spread of the virus domestically had dramatic consequences on the potato market chain in Fouta Djallon in Guinea, a region where case incidences have been minimal. All market-chain actors, especially producers, suffered from lower prices due to the halt of exports to Senegal while the domestic market proved insufficient to absorb production surpluses. As a result, farmers and producer federations faced financial losses with potential long-term effects beyond the 2014 season. The EVD's negative impacts on the potato market chain were likely to be similar in other horticultural market chains that faced the same constraint of products' perishable nature. Vegetable spoilage as a result of restriction measures (e.g. reduction in the number and frequency of trucks in Sierra Leone) and insufficient demand from urban areas also led to lower prices and income reduction in Liberia and Sierra Leone.

Similarly, the closure of border and weekly regional markets had repercussions in Senegal. The availability of fruits and vegetables from Guinea was reduced for Senegalese consumers. In particular, access to food became more difficult for vulnerable communities living in the south (Kolda, Kédougou, Sédhiou).

Some alternatives to the closure of the border and weekly markets in Senegal were implemented by Guinean market chain actors but none of them appeared entirely satisfactory (interview). The bypass via Mali – which did not close its border with Guinea – in order to continue exports to Senegal - considerably increased the length (at the expense of product quality) and costs of transport. Developing exports to Mali instead of exporting to Senegal would involve establishing trader networks, building trust for additional volumes of exports, etc. The transshipment of potatoes at the Senegal-Guinea border directly on the ground leads to the deterioration of products and increases transport costs (return-rates on both sides of the border). In areas of Fouta Djallon where this is possible, FPFD advised its members to postpone harvesting in the hope of higher prices and the reopening of borders.

Organizing trade corridors is therefore an option to be considered when borders are closed for health reasons. The re-opening of the Senegal-Guinea border should also be accompanied by appropriate health controls for sanitary trade corridors. The protocol for organizing such corridors should make use of WHO recommendations in the document *"Ebola Event Management at Points of Entry: Interim guidance"* (WHO, Sept. 2014), adapted for the transport of agricultural products. For instance, a specific area around the border posts on either side of the border could be dedicated to health checks on drivers and possibly commodities by relevant officials (health and agriculture officials in charge of phytosanitary checks) before the usual customs controls. Clear instructions should also be given to law enforcers, particularly at checkpoints, instructing them to give priority to the movement of food and commodities. In some cases, transporters prefer to transport perishable goods (e.g. vegetables) at night when the weather is cooler. These traders should not be restricted to daylight movement of goods.

Furthermore, support measures for producers and the Federation of Producers of Fouta Djallon appeared necessary to counter the financial losses sustained from significant post-harvest losses and steep price drops in potato prices. Financial assistance for reimbursing loans for inputs, subsidising inputs for the following farming season and procuring local food for food distribution schemes were some of the measures proposed by the Federation to support the potato sector (interview).

3.3 Cassava

Highlights

- The cassava market chain was not severely affected by EVD-related restrictions on the movement of goods because cassava is widely produced in the three most affected countries and is not perishable.
- Labour shortages did not affect the cassava market chain as strongly as for other products such as rice because production is far less labour intensive.
- Border closure between affected countries is, however, likely to have disrupted the dynamic of regional trade flows of cassava and gari from Sierra Leone to the sub-region.
- It is recommended that cross-border trade corridors are considered as an option to maintain agricultural trade flows when borders are closed for health reasons.

Cassava is the second most important staple food and a common substitute for rice in the three affected countries. It is widely produced in each of these countries. The main areas of production in Sierra Leone are in Pujehun district. In Guinea, the major producing areas are in Coastal Guinea, South-eastern Guinea, and Upper Guinea but surpluses are produced in Maritime Guinea, Forested Guinea and Upper Guinea while the major deficits areas are in the north of Middle Guinea and Upper Guinea and in and around Conakry (FEWS NET, 2013).

Major domestic trade flows in Guinea move from the southeast to the northeast (Beyla-Kankan) and western parts of the country (Nzérékoré-Kissidougou-Mamou-Conakry or Labé); minor flows supply the northern part of the country (Boké-Gaoual, Mamou-Labé, Faranah-Dinguiraye and Kankan-Siguiri). Dinguiraye is an important market for cassava. During the harvest season, traders bring large quantities of cassava to Dinguiraye where cassava tubers are processed into cassava flour and gari. During the lean season and the period leading up to Ramadan, processed cassava flows to the major urban markets of Guinea (Conakry, Kankan, etc.) as well as to Mali (FEWS NET, 2013). In Sierra Leone, the Barmoi market in Kambia is an important market for cassava because traders from Kenema and Kailahun come there to sell gari to and buy palm oil (FEWS NET, CILSS & WFP, 2010).

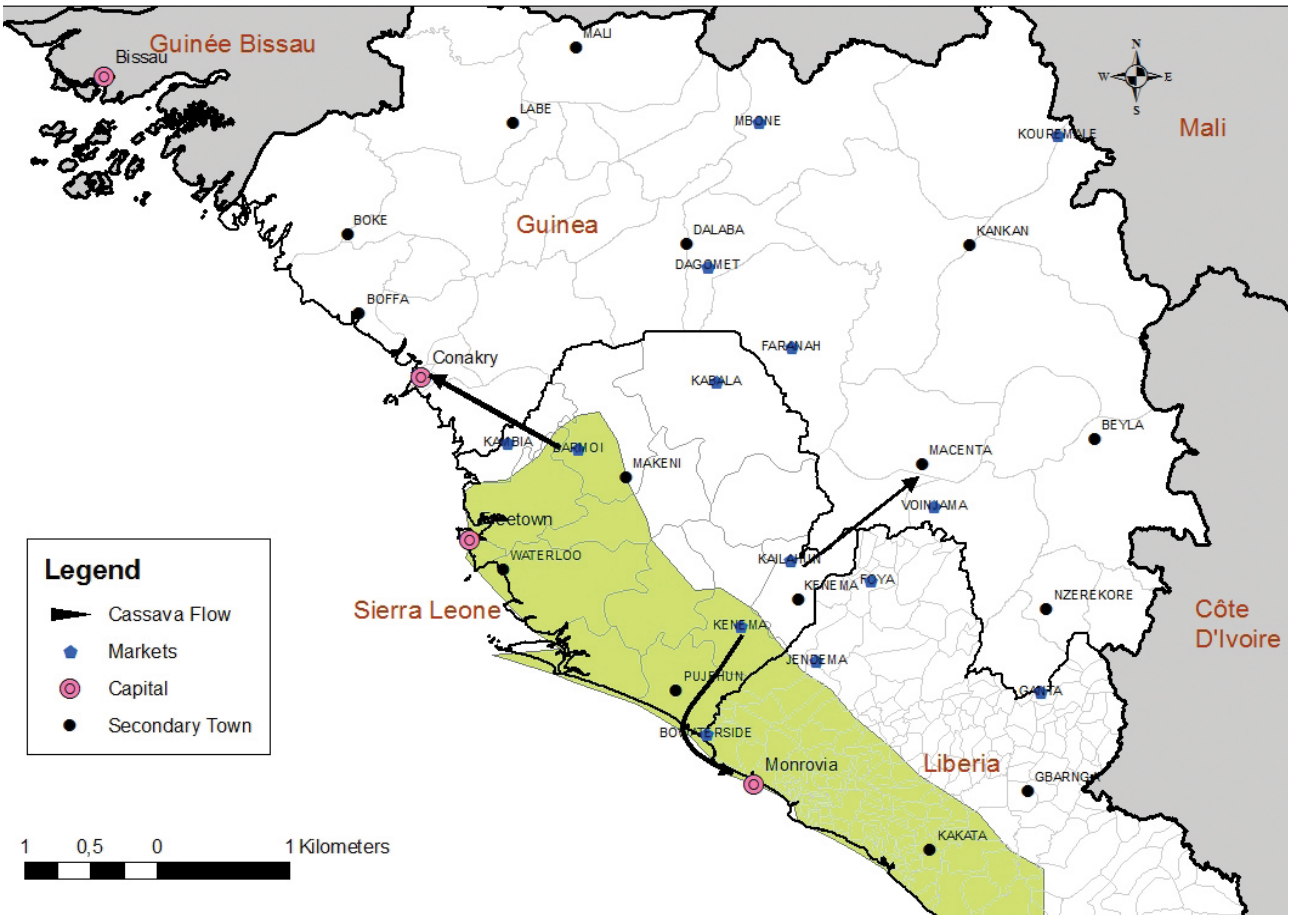
In addition, Sierra Leone is emerging as an important supplier of cassava and gari in particular for Guinea and Liberia *(see Map 7)*. More than 1 000 tonnes of gari per month are exported from Sierra Leone to Guinea. Sierra Leone is the principal provider of gari for the urban markets of Conakry and Monrovia. Gari is a cheap food source and thus contributes to urban household's food security in Monrovia and Conakry (FEWS NET, CILSS &WFP, 2010).

Regional trade corridors for cassava and gari stretch from Sierra Leone through Kambia (200 to 400 tonnes/week) to Forecariah in Guinea and from Freetown to Conakry by canoe. Cross-border flows also exist from Jendema in southern Sierra Leone (600 bags/week) to Bo Waterside and Monrovia in Liberia (60 tonnes/week according to the map below) (USAID, 2012).

©FAO/Riccardo Gangale

©FAO/Riccardo Gangale

Map 7. Cross-border trade flows of gari



Source: FAO, based on FEWS NET, CILSS & WFP (2010).

Little impact on production

Cassava is harvested throughout the year *(see crop calendar in Annex 5)* in all three countries and different studies (FAO-WFP rapid assessments, FAO-WFP CFSAM, FEWS NET) all concluded that there was no major issue with cassava production during the EVD outbreak (little impact according to the rapid assessment in Liberia). Cassava is less labour-intensive than other crops such as rice and can remain in the soil until farmers are ready to harvest, allowing greater flexibility. The crop was therefore not significantly affected by the reduced availability of labour.

However, a reduction in activity was reported in processing by the Lumpa Cassava Processing Growth Centre in Pujehun, the main cassava production district in south east Sierra Leone. Because gatherings were discouraged, farmers who mainly harvest in groups faced difficulties harvesting, leading to a shortage of raw materials for processors (FAO-Sierra Leone, 2014b). In Guinea, the FAO-WFP rapid assessment shows that the cassava trade has been affected (transport restrictions), leading to an increase in cassava stocks in Kerouane (prefecture in the Kankan region).

Similar prices or slight increases

In Sierra Leone, the FAO-WFP rapid assessment (2014a) showed a significant increase (+52 percent) in cassava prices in urban markets between March and August 2014. However, the same study reports that the price of cassava varies by a factor of one to four according to the district and there is no comparison with averages from previous years. FAO Sierra Leone (2014b) reported difficulties for cassava processors to access suppliers of raw cassava because of quarantine measures, restrictions on movement, checkpoints and curfews. This contributed to higher costs in procuring and processing cassava and led to lower volumes of processed cassava and price increases. Other studies reported normal prices or slight increases for cassava. In Kailahun and Kenema, there appeared to be a very slight increase in price compared with other parts of the country according to IGC (2014a), while the WFP mVAM[17] in September 2014 reported normal prices. In Southern Prov-

17 The WFP is tracking food security during the Ebola Virus Disease (EVD) outbreak by collecting data from households through short mobile phone surveys (mVAM surveys). http://vam.wfp.org/sites/mvam_monitoring/index.html

©FAO/Riccardo Gangale

ince, a surplus-producing area for the commodity, cassava flour prices are lowest (WFP mVAM-Sierra Leone, 2014).

In Liberia, significant increases have been observed over short-term periods: for example, cassava increased by 30 to 150 percent within the first two weeks of August 2014 in Monrovia (FAO, 2014), (FEWS NET, 2014a). The WFP mVAM conducted in Liberia reported stable prices (WFPmVAM-Liberia, 2014). At the regional level, the November 2014 mVAM (WFPmVAM-regional, 2014) concluded that cassava prices were in line with usual patterns (seasonal increase).

Higher consumption as a substitute for rice

The only observation gathered regarding cassava consumption is from the mVAM in Guinea which highlights the consumption of less-preferred food products, undoubtedly the result of a substitution effect from rice to cassava (WFP mVAM Guinée, 2014).

Conclusions and recommendations

The cassava market chain was not severely affected by the EVD outbreak. Several characteristics of this market chain can explain this limited impact. Firstly, the production of cassava is far less labour intensive than the rain-fed production system for rice, for example. Labour shortages, restriction measures and fear behaviours therefore had far less impact on the production cycle. Secondly, cassava is widely produced throughout the three most affected countries and, unlike horticultural products, is not perishable. The EVD-related restrictions on the movement of goods have therefore had less impact on trade flows from production to consumption areas.

However, the border closure between affected countries has affected the dynamics of regional trade flows of cassava and gari, especially from Sierra Leone to the sub-region.

It is therefore recommended that cross-border trade corridors are considered as an option to maintain regional cassava trade flows when borders are closed for health reasons. Similar to the recommendations concerning potatoes, the protocol for organizing such corridors should rely on WHO guidelines in the document *"Ebola Event Management at Points of Entry: Interim guidance"* (WHO, Sept. 2014), adapted to the transport of agricultural products. For instance, a specific area around the border posts on either side of the border could be dedicated to health checks on drivers and possibly commodities by relevant officials (health and agriculture officials in charge of phytosanitary checks) before the usual customs controls.

3.4 Palm oil[18]

Highlights

- The temporary closure of industrial plantations led to job losses and decreased purchasing power, but did not affect the international market. The surge of foreign investment following years of civil war in Sierra Leone and Liberia experienced a temporary slow-down.
- Regional trade suffered from the closure of border markets. Domestic trade was less affected but as a result of a reduced number of traders, farm-gates prices likely reduced as well.
- Consumer prices remained relatively stable with some occasional increases of up to 30 percent in some capitals.
- Major recommendations are to re-open regional markets, e.g. Ganta market in Sierra Leone and to support producers in affected areas to market their palm oil production themselves.

An important cash and food crop for local livelihoods

Palm oil production, processing and trade represent attractive activities, accessible to the poorest households. They contribute to household food security as they require little investment and provide various types of work to unskilled workers. Moreover, palm oil, whether locally produced or imported -from Asia- represents a large part of urban and rural household food consumption (FEWS NET, 2014a; FEWS NET, CILSS, FAO, & WFP, 2010a; Rafflegeau, 2014).

The importance of palm oil in the area is illustrated by the following figures: in Liberia, 22 percent of households are involved in palm oil production; in Sierra Leone, palm oil ranks second or third as an income source in rural areas; and in Guinea, 80 percent of palm oil production is artisanal with women playing a central role in processing and trade (FEWS NET et al., 2010a; Tailliez, 2007).

Palm oil trade is organized through three main market chains (FEWS NET et al. (2010a); interview):

- Global export. The civil wars in Sierra Leone (1991-2002) and Liberia (1989-1996 and 2001-2003) destroyed these countries' infrastructure, including palm oil mills. In recent years, large companies have reinvested in these countries and today Liberia and Sierra Leone trade palm oil on international markets. Large companies operate in Guinea (in N'Zérékoré), Liberia (large companies have recently invested in oil palm planting, e.g. Sime Darby, one of the world largest producers of palm oil, Golden VerOleum and Sinar Mars) and Sierra Leone (Gold Tree, Socfin Agricultural Company), using land leases and sometimes facing resistance from local communities (e.g. in Pujehun, Sierra Leone).
- Cross-border regional trade *(see Map 8)*. Palm oil represents a significant cross-border trade in the area, with Sierra Leone emerging as a growing supplier for the Guinean market. Palm oil is traded from Sierra Leone (Barmoi market, near Kambia, handles approximately 30 000 litres of palm oil every week, two-thirds of which are traded to the markets of Madina and Bonfi in nearby Conakry) and Liberia (Ganta market – a wholesale and retail market - in Nimba County, handles 90 000 litres of palm oil every week during the marketing season, of which 60 percent are exported to Guinea). Guinea exports and re-exports palm oil to Senegal through the Diaobé market- and to Gambia (FEWS NET et al., 2010a; Sy, 2002).
- Domestic trade involving small-scale stakeholders, mainly women, over small distances. Oil is sold on roadsides, and is rarely recorded for statistics and therefore probably largely under-estimated. A study conducted in Guinea in 2002 indicated that the majority of palm oil produced using artisanal

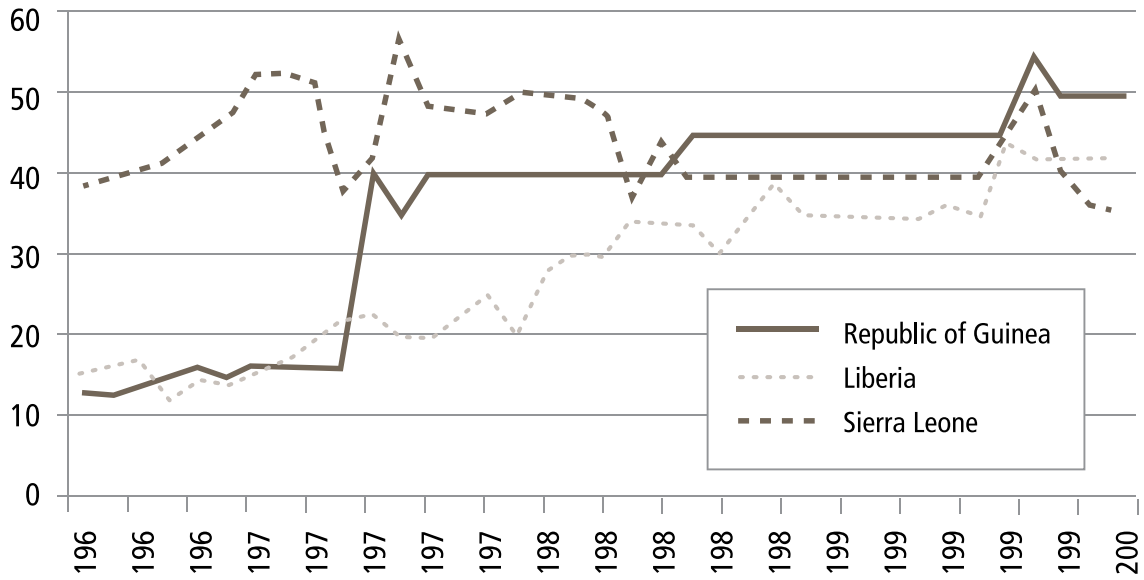
18 Thanks to Sylvain Rafflegeau (Cirad) and Patrice Levang (IRD) for their contribution.

methods (90 percent of families visited) was sold locally in the village of production or at the weekly market if it could be reached without incurring transport expenses (Sy, 2002).

These three market chains involve different qualities of palm oil (industrial, artisanal and traditional). Palm oil can be stored but the quality decreases after four months (acidification).

Statistical data generally only takes industrial production into account. Considering this limitation, palm oil production is estimated (in 2000, Index Mundi) at 50 000 tonnes in Guinea (20th producer), 36 000 tonnes in Sierra Leone and 42 000 tonnes in Liberia (60 000 tonnes in 2013; Oil World) *(see Figure 1 and Table 3)*.

Figure 1. Palm oil industrial production, kt



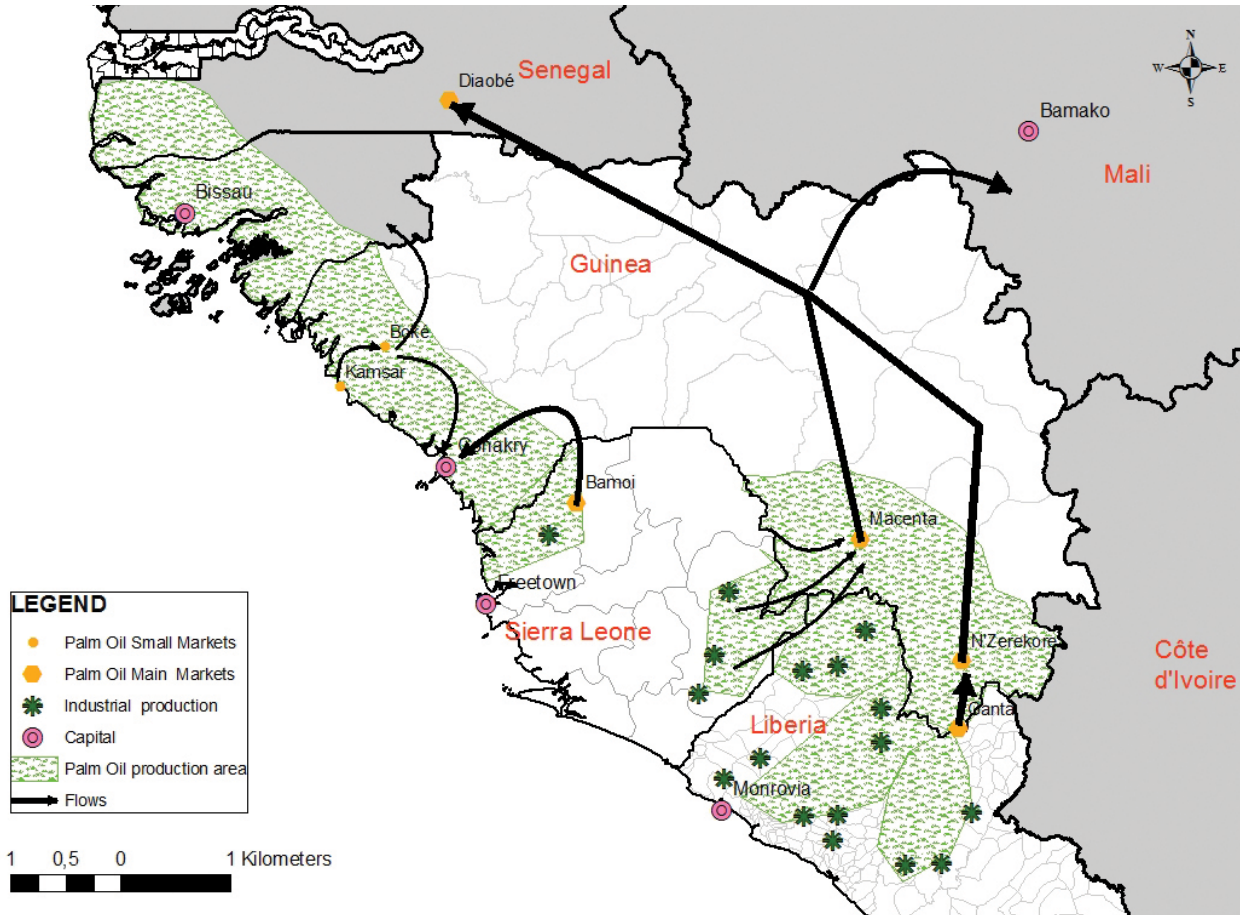
(S. Rafflegeau based on Index Mundi)

Table 3. Industrial palm oil production, import, export and consumption

	Guinea	Liberia	Sierra Leone
Prod., kt, 2000 (and rank) Index Mundi	50 (21st)	42 (24th)	36 (36th)
Prod., kt 2013 (and rank) Oil world	n.a	60 (20th)	n.a
Import, kt, 2013 (and rank) Oil world	77 (63rd)	n.a	n.a
Export, kt, 2013 (and rank) Oil world	n.a	n.a	6 (41st)
Consumption*, kg/cap/an FAO 2013, Jannot 2014	6.4	15.2	11.5

*Including palmist oil
(Source: Food balance sheet, FAO 2013; Jannot 2014)

Map 8. Palm oil cross-border trade flows



Source: FAO, based on FEWS NET et al., 2010a; FEWS NET, CILSS, FAO, & WFP, 2010b; Jannot, 2014

Ebola impact limited by the organizational structure of the market chain

The qualitative risk assessment *(see Annex 2)* concludes that the risk of palm oil being contaminated by the Ebola virus is negligible. Nevertheless, the palm oil market chain has been affected by EVD mainly through trade disruption.

Production was expected to be seriously affected by labour shortages and a 75 percent drop in production was announced in affected areas in September 2014 (World Bank, 2014). This dramatic figure may have been overestimated because it is limited to industrial plantations, where production has indeed decreased. In Liberia, industrial plantations (Sime Darby, Equatorial Palm Oil, Golden VerOleum Liberia) focused on plantation maintenance activities (EPO and GVL websites; World Bank [2014]). Sime Darby evacuated its managerial and supervisory personnel but continued to pay its 3 000 staff members in Liberia (*"as a means of promoting economic growth"*[19]); the Equatorial Palm Oil (EPO) Company reduced its rate of new planting[20].

The impact of this slowdown has limited impact on the international market as these countries' palm oil production does not contribute significantly to international trade and because most of these plantations are quite new and not yet at full operational capacity.

For small-scale producers, processors and traders, one major impact was related to the disruption of cross-border trade due to long periods of market closures (e.g. Ganta and Barmoi markets in Sierra Leone) and border closures. However, it appears that products including palm oil continued to circulate between Sierra Leone and Guinea (the border closure between these two countries was limited and prior to the epidemic, there was significant palm oil smuggling between Kambia district and Guinea [Jannot, 2014]). It is likely that Sierra Leone's growing role in supplying palm oil to neighbouring countries has not ceased completely, although it has been negatively affected. One of the regional palm oil trade routes,

19 http://www.agrimoney.com/news/africa-palm-oil-groups-acknowledge-ebola-threat--7393.html

20 http://www.londonstockexchange.com/exchange/news/market-news/market-news-detail/12138357.html

from Côte d'Ivoire to Senegal through Guinea, was diverted via Mali (FEWS NET, 2014a). Short-distance domestic trade was probably less affected.

Significant price variations have been reported, comparing affected and non-affected areas, or pre-EVD outbreak and EVD outbreak periods, and have been attributed to the epidemic. However, some of these interpretations did not take into account usual geographical (producing and non-producing areas) and seasonal (harvest and lean seasons) price patterns.

Globally and as observed for other agricultural products, prices have been decreasing in production areas and increasing in consumption areas (cities). In Guinea, a higher price differential has been recorded between palm oil production areas (3 000 FG for half a litre of palm oil in Forested Guinea) and other regions (3 600 FG, September 2014). In these regions, stocks were assessed to be lower compared to the same period in previous years (FAO-WFP-Guinea 2014). However, increasing prices have been recorded in specific places including in production areas. These are isolated cases and probably linked to temporary market closures.

In Sierra Leone, a study conducted in August 2014 by the International Growth Center (IGC) recorded similar palm oil prices in Kailahun and Kenema districts compared with other parts of the country. As palm oil is usually cheaper in the two districts than elsewhere, this represents a relative increase compared with past years (IGC, LSE, & University of Oxford, 2014). Major price increases were registered in capital cities (Monrovia, Freetown) - up to 30 percent in Monrovia between July and August 2014 (FEWS NET, 2014) and in Diaobe market (Senegal).

The relatively low increase in palm oil prices (except in capital cities) could be linked to market reorganization. According to some observers, palm oil production that could not be traded on international or regional markets was diverted to national markets. This reorganization is due to the initiative of new economic stakeholders who invested in risky but potentially profitable trade activities. Trading in these areas represented a health and an economic risk (speculative risk), and was therefore not attractive or accessible to all the usual small-scale palm oil traders. Some of these new traders were involved in the cocoa or bushmeat trade before the Ebola crisis. Moreover, to cope with trader defections, farmers in affected areas sometimes organized their own marketing system to supply deficit areas such as urban centres, using the social networks they were able to mobilize. There was, therefore, in some areas a reduction in the number of actors involved in palm oil trade and a negative impact on those with the least economic and social capital. The reduced number of traders affected producers' bargaining power. In other areas, the return of many women previously involved in the bushmeat trade to the palm oil retailing trade, and the local trading of oil previously traded on regional or international markets has led to a saturation of local markets.

Conclusions and recommendations

Trade restrictions reduced the income related to palm oil production, processing and trade for rural households, especially for poor households. The impact was lower on palm oil than cocoa since it is not only exported but also consumed locally.

Cross-border trade was not totally interrupted but suffered from the closure of regional markets and in particular of the Ganta market. This contributed to slowing down Sierra Leone's efforts in positioning itself as a growing supplier of palm oil (along with cassava and rice) in the region. Domestic trade was less affected but as a consequence of a reduced number

©FAO/Ami Vitale

©FAO/Caroline Thomas

©FAO/John Monibah

of traders, prices paid to producers probably fell. Unfortunately, there is a shortage of data in this area (the prices most easily available are market prices).

In order to improve the assessment of the outbreak impact on the palm oil market chain, the diversity and interdependency of the market chains for this product should also be taken into account. Strategies implemented by stakeholders or new stakeholders entering the chain must also be considered. The impact on the trade of oil palm by-products (kernel oil) also needs to be assessed.

The major recommendation is to re-open regional markets such as Ganta market in Sierra Leone. This re-opening requires intensive communication activities and information on Ebola for and by the market's different stakeholders. These activities should focus on early detection and monitoring of new Ebola cases and disseminating hygiene practices that will also benefit other health threats. Moreover, marketplaces should be closed at night and once a week for disinfection.

Another recommendation is to support producers in affected areas to market their palm oil production themselves.

3.5 Domestic animal products

Highlights

- Domestic animal products were affected by consumers' decreased purchasing power and, for the commercial poultry sector, by difficulties in accessing imported animal feed.
- Regional trade in livestock is generally limited. Nonetheless, the trade of animals from Mali via Guinea to Sierra Leone and Liberia was reduced. Similarly, the trade activity of livestock farmers in Forested Guinea to supply Liberia with pigs and poultry was hampered.
- Animal restocking should be targeted where bushmeat consumption was replaced by consumption of small livestock (e.g. Côte d'Ivoire) or where loss of income has caused farm decapitalization (affected areas).
- Current and future projects should be formulated in light of the EVD experience to consider substitution of bushmeat with other animal products and assure wildlife conservation.

A significant contribution to local livelihoods despite low production levels

The area covered by the three main affected countries is not a major area for animal production or consumption compared with other West African countries such as Mali (and to a lesser extent Guinea) *(see Box 1)*. Animal products include mainly small ruminants and backyard poultry, fish, bushmeat, and pork for non-Muslim communities (higher in Liberia than in the two others countries)[21].

In Sierra Leone, in 2007, about 8.5 percent, 6.6 percent and 1.5 percent of households in the country owned goats, sheep and cattle respectively[22,23]. In Liberia the percentages are respectively 8.9 percent, 2.6 percent and 0.3 percent[24]. Cattle are more important in Guinea (with Central Guinea as the main area for livestock[25]) compared with the other countries. The proportion of households engaged in animal production activities is far higher when poultry is included: 92 percent of farming households are engaged in livestock activities for both home consumption and commercial purposes (FAO & WFP, 2014). Most cattle, sheep and goats and poultry graze in free-roaming flocks in villages and their environs.

Meat that is consumed *(see Table 4)* is mainly from livestock raised for home-consumption; in value, home-consumption accounts for 52 percent in Sierra Leone, 35 percent in Liberia and 17 percent in Guinea. Meat consumption is equivalent to around 6.5 kg/cap/year in Sierra Leone in 2002, 7 kg in Liberia in 2005 and 10 kg in Guinea in 2002. As a reference, to fight against malnutrition and under-nourishment, FAO recommends 20 g of animal protein per person per day or 7.3 kg per year. This can be achieved by an annual consumption of 33 kg lean meat or 45 kg fish or 60 kg eggs or 230 kg milk, respectively.[26] However, these figures do not take into account fish and bushmeat consumption

©FAO/John Monibah

21 Nearly 71 percent of total population are muslim in Sierra Leone, 84 percent in Guinea, 13 percent in Liberia (Pew research center http://features.pewforum.org/FutureGlobalMuslimPopulation-WebPDF.pdf)

22 In Sierra Leone's rural areas, the percentage of rural households rearing sheep (8.7 percent) and goats (11.3 percent) is higher than their urban counterparts (sheep, 5.1 percent ; goats, 3.6 percent). Most of the animals are owned by households in the Northern Province, especially in Koinadugu, Kambia, Bombali and Port Loko districts.

23 http://www.fao.org/ag/agp/AGPC/doc/Counprof/Sierraleone/Sierraleone.htm

24 Mainly Grand Gedeh, Maryland, Nimba, River Gee, Grand Kru and Bong. http://www.fao.org/ag/agp/AGPC/doc/Counprof/Liberia/liberia.htm

25 http://www.fao.org/wairdocs/ilri/x5474e/x5474e09.htm

26 http://www.fao.org/ag/againfo/themes/en/meat/background.html

Table 4. Meat consumption in Sierra Leone, Liberia and Guinea

Items	Sierra Leone	Liberia	Guinea
Meat consumption kg/cap/year	6.5[27] (2002)	7[28] (2005)	10[29] (2002)
% home-consumption	52[30] (2003)	35[31] (2007)	17[32] (2007)

Source: National household surveys and FAO

Box 1. Livestock cross-border trade, Liberia and Sierra Leone

"Liberia and Sierra Leone are not major livestock-rearing areas. Meat and milk consumption are low in both countries. As such, demand for meat is largely satisfied through domestic sources for small ruminants and from the north - including Guinea and Mali - for cattle. Livestock supply increases in the rainy season due to household needs for cash to acquire agricultural inputs. In the dry season, animals are in better shape, supply is lower and prices higher. In Liberia and Sierra Leone, livestock traders travel from community to community to buy animals. These animals are taken to enclosures located on main roadways. Livestock are taken from such enclosures to urban areas. Some 80 percent of livestock sold in Sierra Leone go to Freetown, with the remainder to urban areas such as Makeni or to Liberia."

(FEWS NET et al., 2010a).

Red meat and poultry production and trade (regional and international) are boosted by demand from urban areas and from administrative staff from the mining and plantation sectors.

Regional trade of livestock is presented on *Map 9*. Livestock is traded from Mali to Sierra Leone (via Kambia and Kabala) and Liberia through Guinea[33]. In Guinea, M'Boné and Dagomet are important marketplaces for livestock (with at least 11 500 heads of cattle per year sold from the Dagomet market, [Josserand, 2013)]. Most of the livestock traded in Upper Guinea goes to Conakry, Sierra Leone and to a lesser extent Liberia (25 percent of sales in the Dagomet market are of cattle of Malian origin). The vast majority goes to Conakry and around 10-20 percent goes to Sierra Leone (Josserand, 2013; USAID, 2012). In Sierra Leone, livestock trade is mainly in the hands of Fulani; they organize livestock transit in Kabala and its transfer to the Kambia regional market and Freetown. During Tabaski, demand for small ruminants increases: imported sheep arrive on the Barmoi market (near Kambia) from Guinea and on the Kenema markets from Liberia (through Jendema).

Forest Guinea is also developing as a supplier of pork and poultry for the Liberian market. Poultry sector development relies on imports of peanut kernels and fish meal from Senegal (day-old chicks are produced in Guinea). Fish meal is also imported from Côte d'Ivoire to neighbouring countries.

Ebola impact varies depending on the animal market chain

The risk assessment *(see Annex 2)* considered the risk associated of EVD transmission through animal products (other than meat from wild animals). It concluded that provided there is no contact with symptomatic infected people during any stage of the market chain, there is negligible risk of transmitting the Ebola virus through animal products. However, pork remains of some concern, as there is experimental evidence for pigs being infected and able to transmit the disease via aerosol route to cynomolgus macaques[34]. The risk of animal products being contaminated has been assessed as negligible (i.e. so rare that it can be excluded) with processing and cooking.

27 http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_LBR.pdf

28 http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_SLE.pdf

29 http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_GIN.pdf

30 Sierra Leone Integrated Household Survey 2003

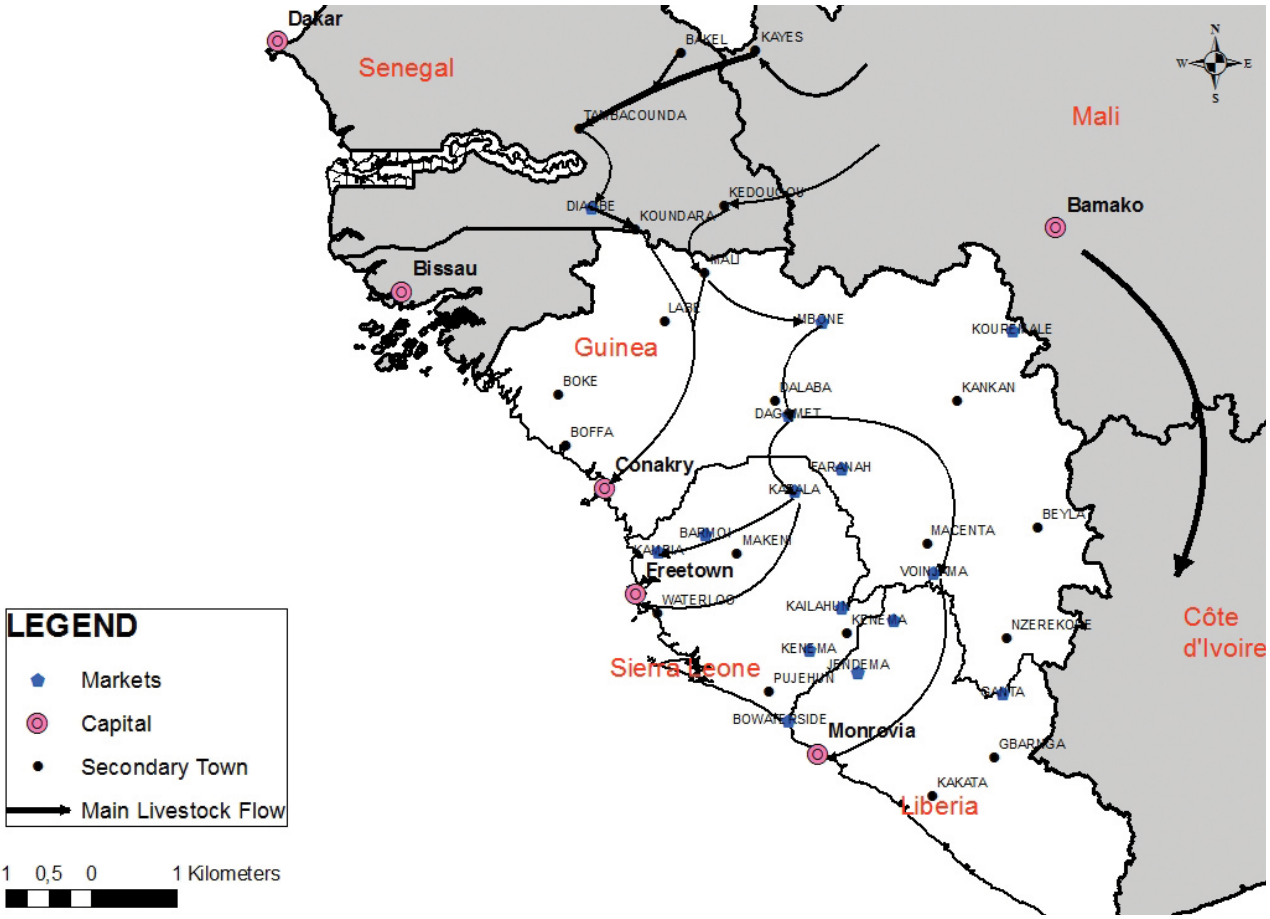
31 CoreWelfareIndicators Questionnaire, Liberia, 2007

32 Enquête Intégrée de Base pour l'Evaluation de la Pauvreté en Guinée, 2007

33 "But Guinea reportedly has nearly 5 million heads of cattle, yet the total volume of imports and exports, according to official statistics, is about 21 000 or less than 0.5 percent of the estimated herd size. The numbers are similar for small ruminants, with around 3.5 million small ruminants and total volume of imports and exports combined at only 20 000" (USAID, 2012).

34 Weingartl et al. Nature 811 (2012)

Map 9. Cattle regional trade



Source: FAO, based on (FEWS NET et al., 2010a, 2010b; Josserand, 2013) and FAO expert meeting.

There was no major sign of a significant substitution of bushmeat by other animal products in the three countries.

Fish farming may have played a partial role in substituting bushmeat. Fishing was banned on international border rivers, since borders were closed, e.g. Cavalla River (Liberia/Côte d'Ivoire) and Mano River (Liberia/Sierra Leone), but increased in local rivers and ponds. In regards to sea fishing, it was reported in Liberia that the EVD outbreak peak coincided with the rainy season and bad weather conditions, especially severe in 2014 in south east Liberia, during which fishing is limited.

Livestock production experienced little impact due to the EVD outbreak as livestock farmers were less likely to abandon their farms for fear of the disease than those without livestock. Regional trade was however disrupted. The Mali-Guinea border remained open, but extended delays for border control (linked to Ebola checks) encouraged herders to use new routes to cross the border, sometimes through planted areas, generating conflicts with local farmers. It is likely that there was an impact on transhumance paths, but this remains to be properly documented and quantified. Decreasing trade activities have been reported by Fulani herders in Koinadugu (Sierra Leone): livestock trade was affected by the closure of the Barmoi weekly market, quarantine measures reduced the number of buyers coming to the area and mining activities ceased in affected areas. Trade from Koinadugu to Barmoi and Freetown decreased up to 60 percent, compared to the pre-Ebola period, which was partly compensated by increased demand by local consumers for beef in order to substitute bushmeat. In Guinea, it was reported that at the beginning of the epidemic that cattle and pigs raised in the forested area were associated with wild animals and their meat was treated with suspicion by traders and consumers.

Commercial poultry production and trade was affected by the Ebola outbreak's impact on imports of peanut, soya kernel and fish meal from Senegal, and fish meal and chicks from Côte d'Ivoire (disrupted by border closure and transport restrictions). The subsequent rising prices of animal feed (up to 75 percent in Forest Guinea) increased production costs that could not be passed on to to consumer due to

decreased purchasing power. In Liberia, the halting of chick imports from Côte d'Ivoire was problematic and lead to a reduction in commercial poultry farmers' income. Commercial pork and fish production relied on local feed and was thus less affected.

Decreases in veterinary inputs supply including vaccines and treatments were also mentioned with no clear impact on the sanitary status of herds at the time the report was written.

Moreover, in Forest Guinea, the border closure with Liberia halted exportation of poultry, eggs and pork and strongly affected the dynamic association of livestock producers in Macenta whose members were developing exports to meet the demand of a growing Liberian market.

Different factors have contributed to decreased demand for some animal products, such as fear of animal products originating from affected areas, the evacuation of managerial and supervisory personnel from the mining sector, and more broadly, consumers' lower purchasing power. Decreased purchasing power probably contributed to keep animal product prices low in affected areas (FAO-WFP-Guinea, 2014). In urban areas, increases in prices were recorded (up by 40 percent for fish in Sierra Leone urban markets, FAO-Sierra Leone, 2014a).

Conclusion and recommendations

Bans on bushmeat did not lead to a major increase in demand for other animal products, even in Liberia where bushmeat consumption is usually high in rural areas.

Bushmeat consumption may have been replaced by the consumption of small livestock (poultry, pigs, small ruminants) and this has consequently led to farm decapitalization. If confirmed, animal restocking should be targeted to help households recover from the EVD epidemic.

Animal product chains have been diversely affected by the EVD outbreak. The commercial poultry sector has suffered from its dependence on imported feed, unlike fish and pork production. Reopening of borders should be organized for feed and animal trade. As suggested in the risk assessment, given that in the event of infection, pigs are expected to show severe clinical signs, a veterinary certification that the pigs are in good health should be required (which is already the case, for example, for pigs exported from Guinea to Liberia) and a period of quarantine before trading the animals will mitigate the risk and allow cross-border trade to resume safely.

©FAO/John Monibah

3.6 Bushmeat[35]

Highlights

- Bushmeat plays an important economic and nutritional role in the affected areas, although this role is decreasing
- Due to EVD, bushmeat consumption has decreased, especially in urban areas, but with no significant substitution effect on other products.
- Recommendations include:
  - o Making the most of the post-Ebola recovery phase to rapidly agree on and draft regulations, ensuring compliance and improving communication messages to guide and control bushmeat market-chain stakeholders' activities. recognizing that they will otherwise likely resume pre-Ebola habits. Measures should be proportionate to risk and should be addressed to a broad audience, from hunters to consumers.
  - o Bans on hunting and bushmeat consumption could be imposed for bats, wild mammals, wild antelopes and any sick (weak) or dead wild animals.
  - o Communication on risks associated with bushmeat should also target children given that they often participate in busmeat hunting in rural and peri-forest areas.

A significant role in nutrition, income generation and pest control

It is difficult to assess the hunting, sale and consumption of bushmeat (or wildmeat)[36] because it is confined to the informal, and sometimes illicit, sector. Furthermore, data is difficult to interpret as units used often lack precision (e.g. whole, emptied or deboned carcasses, or portions/cuts).

Data available for the Congo Basin indicate an annual production of 5 million tonnes of bushmeat (twice the annual beef production in France, and two-thirds of Brazilian production) and a consumption of 7 kg/capita/year for urban populations and 51 kg/capita/year for rural populations (Nasi, Taber, & Van Vliet, 2011).

Updated data on the consumption of wildlife products in West Africa is lacking. Studies conducted in the 1990s indicate the importance of bushmeat in the sub-region: Anstey estimated that three-quarters of Liberian meat production came from bushmeat, with subsistence hunting yielding as much as 105 000 tonnes of meat annually (Anstey, 1991). In the 1990s, bushmeat represented up to 80-90 percent of animal protein consumed in Liberia, 75 percent of animal protein consumed in rural Ghana and 20 percent of animal protein consumed by communities living in tropical wet forests in Nigeria (Ntiamoa-Baidu, 1997). Nevertheless the situation has changed with urbanization, deforestation and reductions in wild animal populations.

More accurate data *(see figures and tables below)* indicate that bushmeat represented up to 23 percent of the value of meat consumption in Liberian rural areas and 7 percent in the capital, Monrovia[37]. However, the figures are lower for Guinea[38] (respectively 18 percent in rural areas and one percent in Conakry) and Sierra Leone (five percent in rural areas and less than one percent in Freetown)[39]. Hunting products are mainly used for home consumption – in Liberia, according to the same source, 62 percent of the value of consumed bushmeat comes from local hunting. It is also a form of pest control and rodents represent an important share of the catch (57.5 per-

35 This chapter benefitted from the contribution of N. Bricas, Ch. Fargeot, S. Lebel, F. Roger (Cirad) and includes parts of FAO mission report (J. Bonwitt et al, FAO 2015a) on "Bushmeat value chain analysis in EVD context", and FAO/AGAH technical report (Plee L. FAO 2015b) "Addressing Zaire Ebola virus outbreaks. Rapid Qualitative Exposure and Release Assessment"

36 We consider "bushmeat" and "wildmeat" as synonymous in this report although we are aware of the existing debate on these two terms.

37 Core Welfare Indicators Questionnaire, Liberia, 2007

38 Integrated Baseline Poverty Evaluation Survey in Guinea, 2007

39 Sierra Leone Integrated Household Survey 2003

40 In markets, ungulates dominate with 75 percent of sales, 15 percent for rodents and 8 percent for primates This same study estimates that hunting provides an income of USD 27/hunter/month (Bene et al., 2013).

Box 2. Different approaches of bushmeat

From the late 1980s, on the initiative of the conservation movement, research has been conducted on bushmeat to assess the impact of hunting on protected species. Most of these studies were carried out near protected areas and focused on the hunting of large mammals threatened with extinction and on commercial hunting. It is only later that the study of the socio-economic and nutritional dimensions of hunting gave rise to better understanding of new aspects: hunting of small species (rodents, small antelopes) that were of little interest for bushmeat consumer, hunting in anthropized areas (on the confines of farms) and hunting for one's own consumption.

The bushmeat sector is relatively well understood in the Central African zone where much research has been undertaken (see summary in Fargeot 2013). In West Africa, hunting resources are less abundant and conservation issues are less present than in Central Africa. Research on bushmeat is thus more scarce.

There are generally considered to be two opposing views on the consumption of bushmeat. The first view condemns bushmeat hunting as a threat to biodiversity caused by high rates of hunting. It is adopted by several NGOs (WCS, WWF, etc.) that have joined forces under the *"Wildmeat Crisis Taskforce"*[41] and recommend to halt bushmeat consumption as it threatens the survival of several species, encourages criminal activity (95 percent of the market chain is illegal), and for ethical reasons. The AIDS crisis and now the EVD epidemic offer new arguments to remind people of the health risks associated with the consumption of bushmeat. In the opposing view, the emphasis is on the fact that hunting is kept at reasonable and sustainable levels (hunting is always regulated in some way) and concerns mostly "common" fauna (rodents, small antelopes, etc.) that are in part associated with anthropized environments. Bushmeat here is also considered as contributing to the food security of many households and communities in rural Africa, with traditional preparation and cooking practices (drying, long cooking) supposedly limiting health risks. The debate on bushmeat in the context of the Ebola health crisis is reviving these two approaches.

cent) according to a study conducted in Northern Nimba county in Liberia (Bene, Gamys, & Dufour, 2013)[40].

While the meat of certain wild animals is considered a luxury by some urban consumers, bushmeat is more often consumed in rural areas by poor households for whom it is the most affordable meat. In the 1990s, its price was often lower than that of other types of meat in Central Africa (Bahuchet, 2000).

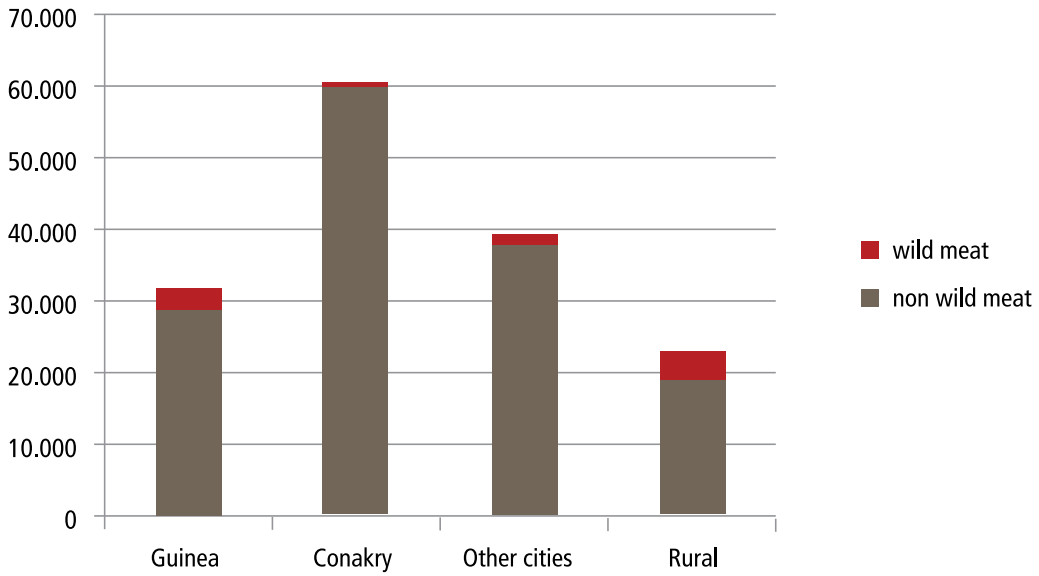
©FAO/Jesse Bonwitt

Bushmeat consumption may in some cases be limited by religious prohibitions (Islam) or totemic restrictions (the case of cat, monkey or some rat species in Guinea) (FAO 2015a).

For Crookes and Milner-Gulland (2006), the sustainability of hunting is at risk due to increasing demand for bushmeat, population growth and the loss of native wild species. Increasing demand is linked to growing rural poverty and demand from urban populations, improved gun technology, road infrastructure and weak natural resources conservation governance. However, other authors (Fargeot 2013) feel that urbanization and urban consumer habits are contributing to reducing demand for bushmeat.

41 http://www.bushmeat.org/bushmeat_and_wildlife_trade/what_is_the_bushmeat_crisis

Figure 2. Value of bushmeat and non-bushmeat consumption, Guinea (per capita, in national currency)



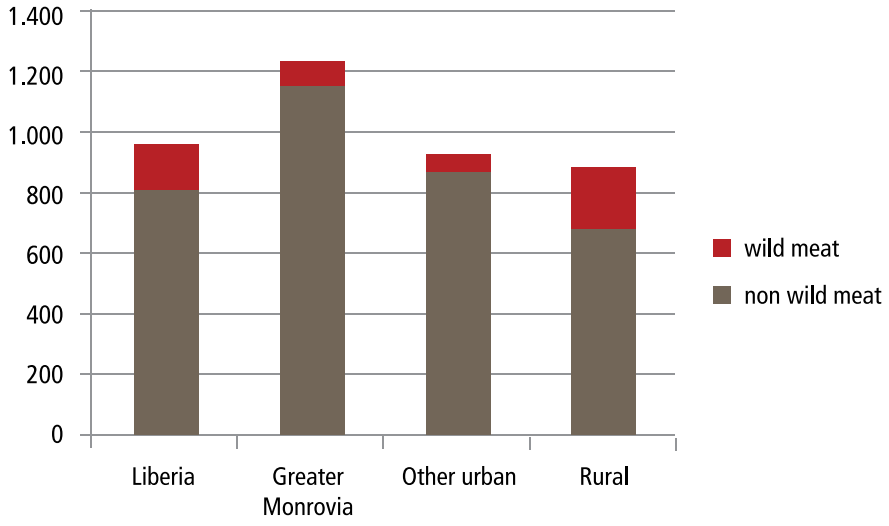
Source: Bricas and Figuié, based on a national survey (Integrated Baseline Poverty Evaluation Survey in Guinea, 2007).

Table 5. Bushmeat consumption (share in value), Guinea

Republic of Guinea	Entire country	Conakry	Others cities	Rural
Share of bushmeat in the value of meat consumption (%)	10	1	4	18
Home -consumption of bushmeat in total bushmeat consumption (%)	38	0	10	41

Source: Bricas and Figuié, based on a national survey (Integrated baseline survey on poverty evaluation in Guinea 2007).

Figure 3. Value of bushmeat and non-bushmeat consumption, Liberia (per capita, in national currency)



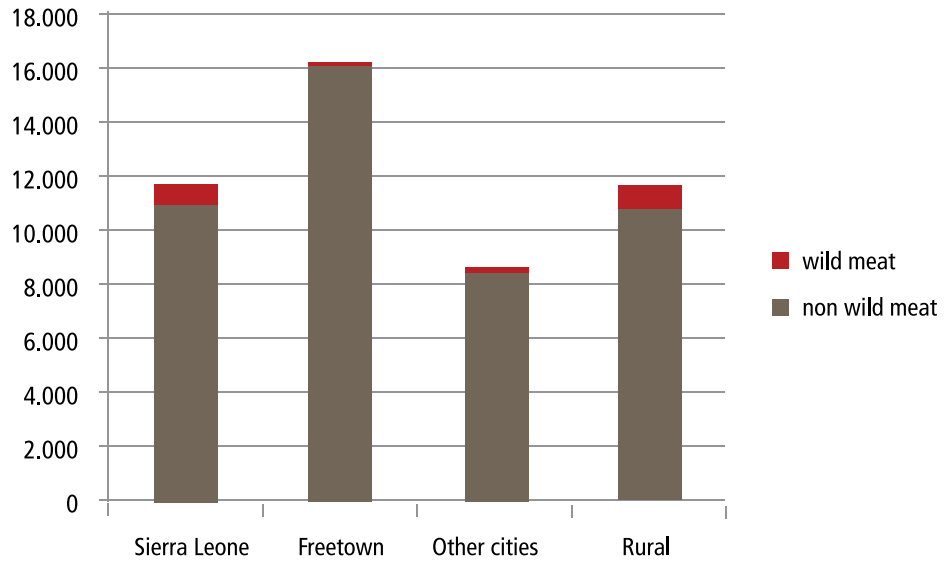
Source: Bricas and Figuié, based on a national survey (Liberia Core Welfare Indicators Questionnaire 2007).

Table 6. Bushmeat consumption (share in value), Liberia

Liberia	Entire country	Greater Monrovia	Others cities	Rural
Share of bushmeat in the value of meat consumption (%)	17	7	7	23
Home - consumption of bushmeat in total bushmeat consumption (%)	54	5	18	62

Source: Bricas and Figuié, based on a national survey (Liberia Core Welfare Indicators Questionnaire 2007).

Figure 4. Value of bushmeat and non-bushmeat consumption, Sierra Leone (per capita, in national currency)



Source: Bricas and Figuié, based on a national survey (Sierra Leone Integrated Household Survey 2003).

Table 7. Bushmeat consumption (share in value). Sierra Leone

Sierra Leone	Entire country	Freetown	Others cities	Rural
Share of bushmeat in the value of meat consumption (%)	3	0	2	5

Source: Bricas and Figuié, based on a national survey (Sierra Leone Integrated Household Survey 2003).

A study conducted in Guinea (FAO 2015a) lists several reasons that bushmeat hunting and consumption is popular in the country:

- Access to inexpensive sources of protein and to delicacies (a small quantity is sufficient to flavour a dish);
- Health: the cane rat *(Thryonomys spp.)*, for example, is considered a lean meat particularly suited for the elderly or those suffering from hypertension; monkey brains are used to treat dizziness; dried intestines of porcupines to treat stomach aches; warthog or buffalo ears to treat fever, etc.;
- As a means of undertaking an activity that is highly valued from a socio-cultural perspective in rural areas. Hunters enjoy a special social status and hunting products sometimes have a "ceremonial" function (ex: red-backed duiker organs distributed to the family during weddings in some forest ethnic groups).

The bushmeat market chain before Ebola

The organization of the bushmeat market chain is presented in Figure 5 for Côte d'Ivoire. More detailed information is provided by the FAO study in Guinea (FAO, 2015a).

The market chain in Guinea is made up of several categories *(see also Box 3)*:

- **Subsistence hunting**

  This includes domestic (family) hunting and consumption at a local level. Included within this category are all forms of capturing animals (traps, net traps, smoking of burrows) and it mainly concerns small and medium-sized catch (hedgehogs, porcupines, duikers, pangolins, antelopes, primates, rodents and bats). This category also includes children's hunting of small species that are easy to catch such as rodents (with traps) and bats (with slingshots or fire).

- **Commercial hunting**

  Commercial hunting is part of a market chain that is relatively organized and includes hunters, processors/wholesalers, transporters, retailers and consumers. Hunters often work directly with wholesalers who accompany them on hunts and smoke the meat on site. The meat is then transported in 50 kg bags to consumption zones and is subject to a Ministry of Environment levy. Retailers (who are sometimes also wholesalers) are mainly women and play a crucial role in preparing, transporting and selling bushmeat. Upper Guinea and Middle Guinea are the main hunting areas, while Forest Guinea, Liberia and Sierra Leone tend to be areas of consumption. The mainly Muslim region of Upper Guinea exports a large amount of warthog meat to the mainly Christian Forest Guinea region. The price of meat varies widely depending on the species and region.

- **Professional hunting**

  This hunting involves large species including buffalo, and more rarely hippopotami (protected species) that represent a potential threat for farmers'crops. Authorization from local forest authorities is required.

Box 3. Types of hunters

According to Davies, Schulte-Herbruggen, Kumpel, and Mendelson (2007), there is a wide variety of types of hunters. At one extreme are people for whom hunting is their primary activity, at least at certain times of the year and who hunt in their region of origin and from temporary camps in zones with low human presence. They seek high market value species and may hunt protected species. At the other extreme are farmers who hunt around their villages or in the "farmbush", often with traps, looking for the nutritional value of meat and to reduce pest damage to their crops (Davies 2007). Hunters are sometimes organized in powerful fraternities (as in Guinea) that can take the form of paramilitary groups, as was observed during the civil war in Sierra Leone (FAO 2015a).

Processing

- **Drying/smoking/curing:** the meat is cut and boiled at the hunting site. It is then covered with leaves, dried and smoked on a rack for at least 24 hours.

- **Smoked meat can be stored for several weeks** or kept under oil to be consumed during the lean season.

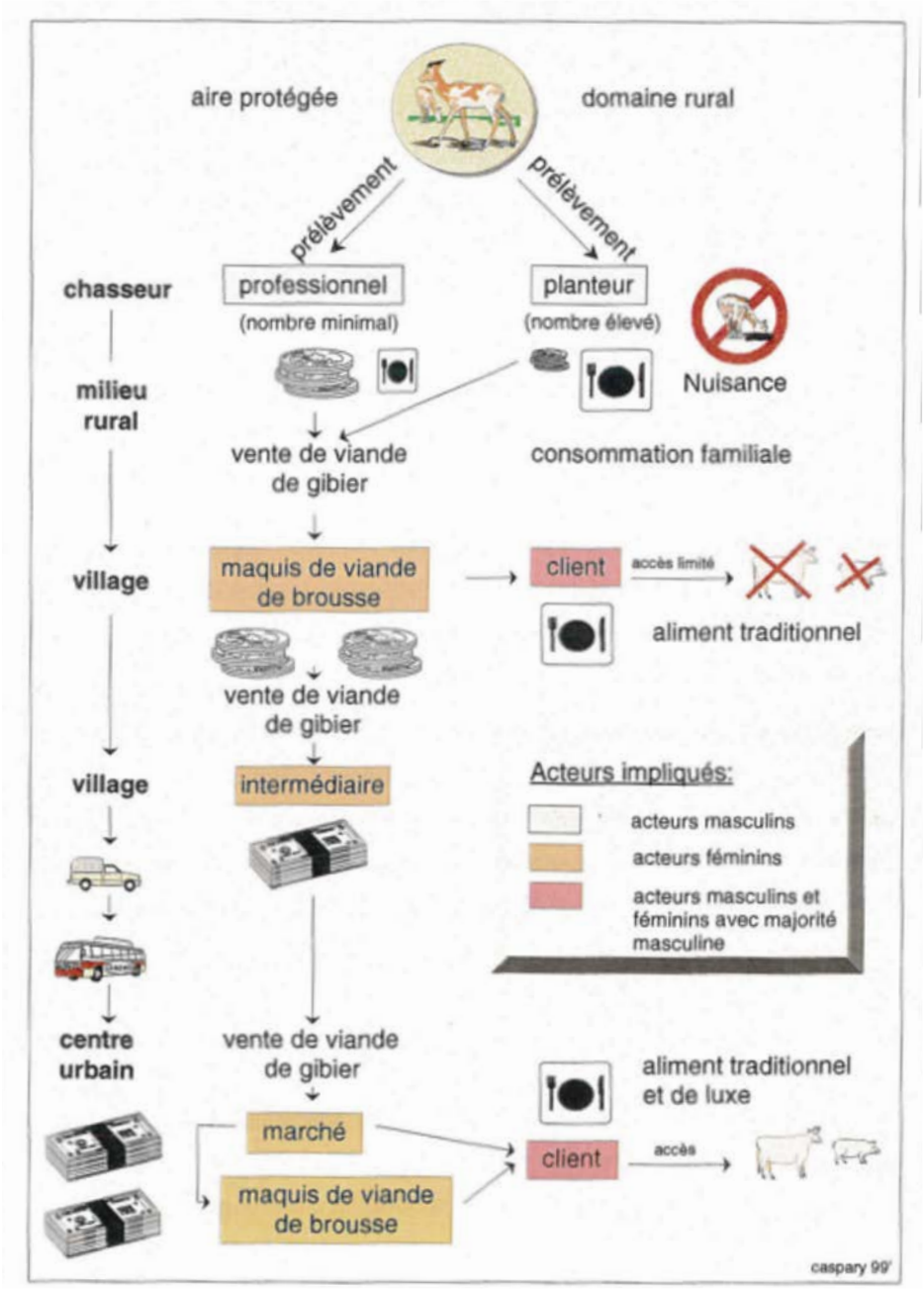
- Game (butchered or whole) is sold fresh if it has been hunted within 50 km of the place of sale.

Studies from Cameroon suggest that a third of the meat on the market in Yaoundé is sold fresh and primarily (80 percent) by women butcher-sellers (Bahuchet, 2000). Bahuchet notes that in the early 1990s, resellers in Cameroon had the highest profit margins with prices that could increase by a factor of three to ten (Bahuchet, 2000).

Box 4. Hunting of bats in Burkina Faso

A press article published in Burkina Faso (Welman Guingan, Sept. 2011) provides details on the hunting of fruit bats. In the country, the fruit-bat hunting season is opened by ministerial decree for a period of two months (generally from 1 July to 31 August). Hunters are obliged to have a special fruit bat hunting permit (FCFA 5 000 for nationals and FCFA 25 000 for foreigners). One single fireshot can kill up to a dozen bats and a hunter can catch 45-50 bats in one day. In Ouagadougou, several restaurants offer dishes with bats: restaurant owners buy the bats at FCFA 500 from the hunters and sell cooked dishes between FCFA 750 and 1000 (these prices may be lower in other areas as in Ouargaye where bats cost FCFA 250 per unit and bat dishes are sold at FCFA 500). In 2014, hunting was suspended at the end the month of July due to Ebola-related risks.

Figure 5. Bushmeat supply chain in Côte d'Ivoire



Source: Caspary (1999)

Bushmeat exports

Cross-border trade is abundant between Guinea, Liberia and Côte d'Ivoire. Over longer distances, 7 500 tonnes of illegal meat enters the United Kingdom each year, the bulk of which is bushmeat[42]. These figures may be even higher: Chaber et al. estimate that each week, five tonnes of bushmeat are imported illegally in the personal luggage of travellers arriving at the Paris CDG airport in France, for both personal consumption and trade (Chaber, Allebone-Webb, Lignereux, Cunningham, & Rowcliffe, 2010). However, this figure is considered an overestimation by several experts.

In the United States, imports of bushmeat are forbidden and subject to a USD 250 000 fine (CDC 2014 cited by [IUFoST, 2014 Nov.]).

42 http://www.dailymail.co.uk/news/article-2713707/Secret-trade-monkey-meat-unleash-Ebola-UK-How-appetite-African-delicacies-British-markets-stalls-spread-killer-virus.html#ixzz3CpntQvbl

Major impact on bushmeat trade and urban consumption but minor impact on rural consumption

Soon after the outbreak of the EVD epidemic, the hunting, trading and consumption of wild animals was banned and awareness-raising messages were spread in an effort to stop the consumption of some or all species of wild animals. It is important to highlight that with the exception of at least one zoonotic case (the likely index case), the EVD epidemic was spread due to sustained human-to-human transmission (Baize et al., 2014; Gire et al., 2014).

In early 2015, FAO released a rapid qualitative exposure assessment in order to evaluate the role of wild meat and related activities in the spread of the Zaire Ebola Virus (EBOV) to the human populations (FAO, 2015 b). The report concludes *(Box 5)* that the likelihood of spillover to a human being from wild mammalian species is very low. Nevertheless, the report noted that: *"Even if such spillovers can be viewed as rare events, their consequences are nonetheless disastrous"*.

©FAO/Jesse Bonwitt

In the past, various measures have been taken to restrict the hunting and consumption of bushmeat in order to protect wildlife in Africa. Most measures attempt to prevent poaching and are very expensive and not very effective (Damania & Bulte, 2007). Other tools are recommended, notably through market chain action (*"supply side policies"*). For example, plans to supply the market with farmed bushmeat have been sometimes recommended. However, Damania and Bulte (2007) believe these measures can be counterproductive: the risk is to reduce prices of both bushmeat from the bush and farmed bushmeat, thus increasing pressure on the hunted resources. According to several sources, the best way to change hunting behaviour is information/education (Le Breton et al., 2006).

The bushmeat market chain was severely affected by the EVD outbreak. This might be related to the bans on bushmeat, or more probably to the fear of the disease itself. Field studies in Guinea (FAO, 2015a) show that there was significant confusion and doubt for hunters, marketers and consumers throughout the market chain on the role of wildlife and bushmeat in the spread of EVD. It is of note, however, that bats, primates and other animals found dead were generally avoided since the beginning of the epidemic[43]. A disconnect was noted between the very general awareness raising messages circulated on health risks related to bushmeat, and communities' perception of risks, which varied significantly according to the types of human-animal contacts, the wild species concerned, their habitat and the type of product consumed (fresh versus cured meat).

A halt in hunting and bushmeat trade following the bans might indicate, according to the figures quoted previously, a loss of income of USD 27/month for hunters and a decrease in meat consumption of 5 to 23 percent (in value) in rural areas, depending on the country. However, it is highly likely that bushmeat consumption has not ceased in many rural areas where wild animals represent the most affordable source of meat, with the exception of the hunting and consumption of bats and primates which has likely decreased since the EVD outbreak. In Guinea, children still hunt small animals to eat as a snack.

According to the FAO study, in Kankan, hunters did accepted the ban on hunting for cultural or food security reasons and also because of ongoing doubts and scepticism on the actual existence of EVD. However, hunters interviewed in Forest Guinea reported having halted hunting bats and primates and collecting animals found dead.

The same study indicated that commercial hunting was most affected. Some sellers lost a significant part of their capital during the confiscation and destruction of bushmeat stocks. Some of them nevertheless continued their activities illegally, but most are still reluctant to invest in bags of meat (the value of a bag of wild meat is around GNF 1-5 million, equivalent to USD 140-710) given the risk of confiscation. Some have converted to selling other products, such as dried fish. Nevertheless, apart from bats and primates for which consumers remain afraid, bushmeat dishes in small local restaurants can be found easily. The FAO study showed that the announcement of the end of the epidemic could incite market-chain players to return rapidly to their previous activities.

Box 5. Hunter and trader reaction to the bushmeat ban

> **Nigeria.** "Musa Maibigidar, who makes his living hunting monkeys and other animals to be sold as meat at the market, says the local hunters' union has agreed not to hunt for now, but they will go back to work when the weather is dry. Maibigidar believes officials who say Ebola can be transmitted from animals to people - even though this has never happened in Nigeria, where people have been eating bushmeat as long as anyone can remember". Maibigidar says for now, people aren't even buying bushmeat for fear of Ebola. But like the hunters, he thinks people will eventually be more afraid of hunger than disease[44]" VOA News, 26 August, 2014.

Conclusion and recommendations

According to the testimonies of some observers in rural areas, bushmeat consumption may not have decreased significantly. Stopping bushmeat hunting and consumption may be difficult for food-insecure households because of reduced income, production and access to markets. Moreover, reducing hunting of pests may lead to increasing crop damage. Therefore, hunting bans could be focused on some specific species as suggested by the FAO rapid risk assessment (FAO 2015b).

43 As of today, the only species found naturally infected (and symptomatic) with EVD are gorillas, chimpanzees and duikers.

44 http://www.voanews.com/content/amid-ebola-scare-nigeria-shuns-dancing-monkeys-bush-meat/2428545.html

Communities should be advised that:

- Hunting, slaughtering, selling, preparing and consuming bushmeat that originates from any species of bats should **be avoided at all times**;

- **Handling**, slaughtering, selling, preparing and consuming bushmeat that originates from mammalian species, such as gorillas *(Gorilla gorilla)*, chimpanzees *(Pan troglodytes)* and wild antelopes *(Cephalus spp.)* **found sick or dead should be avoided**. Since these species are protected, their hunting should be prohibited in any case.

Communication on risks associated with bushmeat should also target children who hunt in rural areas. The messages should also clarify the EVD risk associated with domestic animals raised near forested areas (because this is confusing for some consumers).

The situation also raises the issue of the impact of different projects whose aim is to reduce bushmeat consumption and offer alternative products in order to protect wild animals. Game ranching is one of these alternatives. However, in Benin, cane rat production was also affected by EVD through restrictions on bushmeat and consumer fear, although no EVD was ever reported. Poultry and guinea pig production are other alternatives; nonetheless, commercial poultry production in Guinea demonstrated the fragility of animal production due to its dependence on imported feed.

It is important to reflect now on the measures to be taken for the bushmeat market chain when the epidemic has ended, including continued communication campaigns targeting urban and rural residents. Additionally, policy decisions must be taken on whether to reopen or partially continue the ban on hunting, trade and consumption of bushmeat and how it can be better regulated, and tracked. It is essential to draft pragmatic and consistent regulations and to develop clear communication strategies to avoid hesitation and confusion.

Boxes 6 to 10 provide complementary information from scientific studies on bushmeat in West Africa.

45 http://rainforests.mongabay.com/20sierraleone.htm

46 For the perception of risks see also Adefalu et al., 2012; Le Breton et al., 2006)

Box 6. Studies on bushmeat in Sierra Leone

In Sierra Leone, the hunting and trade of wild animal products essentially take place near protected areas (4.5 percent of the territory), forest areas (38.5 percent of the territory)[45] and farmbush areas.

A study undertaken in different sites in the south of the country by Subramanian in 2012 shows that hunting is widely practised on a regular basis (at least once a week) and in 70 percent of cases it is for consumption and trade. This kind of hunting essentially relies on wire snare traps and dogs and never uses fire arms.

Preferred species are rodents, in particular the greater cane rat *(Trynomis swinderianus)*, Maxwell's duiker *(Philantomba maxwellii)* and the bushbuck *(Tragelaphus scriptus)*; there is less demand for chimpanzees, buffalos and warthogs (Subramanian 2004).

Subramanian (2012) showed that although men do the hunting, it is women that dress the carcass and butcher the meat and are thus proportionally more often exposed to infection than the hunters themselves. The study showed that 24 percent of those surveyed were aware of the risks of transmission of zoonotic diseases linked to hunting and the consumption of bushmeat.[46]

In Sierra Leone, ungulates represent around 30 percent of sales, while primates and rodents represent 50.5 percent and 11.5 percent of sales respectively (Davies et al., 2007). Some ethnic groups in Sierra Leone have taboos about the consumption of some great apes (as is the case in parts of Equatorial Guinea and eastern DRC) whereas other groups prefer to hunt great apes (Davies et al., 2007).

Box 7. Studies on bushmeat in Liberia

Anstey (1991) produced a study that showed that in 1989 bushmeat represented 75 percent of meat produced in Liberia and had a trade value of USD 24 million, greater than the value of the trade in wood (USD 20 million). Bushmeat procured USD 100 to 120 per month in revenue for women sellers; the market sales price was 2 to 3 times higher than what was paid to hunters. According to Anstey (1991), 97 percent of people in Liberia in 1989/1990 consumed bushmeat.

In 2013, hunting procured a revenue of USD 27 per hunter per month for hunters in Mount Nimba in the north of the country (Bene et al., 2013).

Hoyt (2004) described the bushmeat market chain in Liberia which showed that it was targeted both towards home consumption and trade, with direct sales made by hunters or via collectors (often women) and sometimes via *"contracts"* (where a seller or transporter provides in advance munitions to hunters). In a survey of urban consumers (in 2002), only half of respondents said they had not consumed any bushmeat over the course of the previous week. Preferred species were the cane rat, the water chevrotain, the giant pangolin, the black duiker, the brush-tailed porcupine and the bushbuck. The majority of respondents did not know whether any of these species were protected and did not think that they were likely to disappear (Hoyt, 2004).

Bene et al. (2013) carried out research on hunting in Mount Nimba in northern Liberia. The hunters there are farmers who use arms and traps to catch mainly rodents (57.5 percent of the catch), ungulates (20.5 percent), carnivores (13 percent) and primates (3 percent). The meat is mainly used for family consumption. Part of it is sold on local markets or goes to neighbouring countries (Guinea, Côte d'Ivoire) with whom trade is vibrant (there is movement of bushmeat in both directions). The relative importance of species varies according to the points of the market chain. In marketplaces, one finds mostly ungulates (75 percent), rodents (15 percent) and primates (8 percent) with, in order of importance, mangabey, Campbell's monkey, Diana monkey, and lesser spot nosed baboon. In restaurants, wild swine species predominate.

Box 8. Studies on bushmeat in Guinea

Ziegler (1996) carried out a study on hunting in the Upper Niger national park (Guinea). The study shows that hunters travel up to 30 km from their villages to hunt with arms, alone or in small groups of less than five, and cut and smoke their catch at the hunting site. Hunting is more intense during the dry season (except for baboons which are hunted during the rainy season to protect crops) and is most often practised at night and before market days.

Dufour (2013) estimated that 3 912 kg of animal biomass were hunted over a 12 month period in Forecariah/Kounoukan (for 223 hunters), 5 475 kg in Fouta Djallon (275 hunters) and 5 181kg in Upper Niger (180 hunters) with a frequency of bushmeat consumption of once to three times a week.

Brugiere and Magassouba (2009) estimated that the annual catch of 16 villages (8 500 inhabitants) in the Upper Niger park was 335 000 kg/year, of which, 53.5 percent was ungulates and 25 percent was rodents – 81 percent and 11.5 percent in terms of biomass respectively. They estimated that 40 percent of the bushmeat hunted was home-consumed (with a range of 20 to 70 percent between villages). Trade in bushmeat corresponded to 35.2 kg per habitant per year.

Primates were hunted to the extent that they posed a threat to farming during the rainy season. Muslims (mainly Malinkes) do not consume the meat of primates (Brugiere & Magassouba, 2009).

Box 9. Studies on bushmeat in Côte d'Ivoire

In Côte d'Ivoire in 1999, according to Caspary (1999), national consumption of bushmeat was twice as much as the national production of farmed meat and provided half the animal protein consumed by farmers. In 1990, an average quantity of 20.3 g of game meat per person/day was consumed, with urban bushmeat consumption amounting to 8.7 g/person/day. People living in urban environments consumed 3.5 times less bushmeat than rural inhabitants (30.4 g/person/day) (Chardonnet, 1995). In 1990, overall bushmeat consumption was estimated at 83 500 t/year. (figures based on the results of the 1979 *0* and an assumed home-consumption rate of the rural population of 80 percent - Chardonnet et al, 1995.)

Hunting represented 1.4 percent of GDP, a figure comparable to the contribution of the wood sector and higher than the contribution of banana or pineapple (Caspary, 1999), where 120 000 tonnes of carcasses were caught in 1996 in Côte d'Ivoire, 50 percent of which were cane rats and squirrels.

Box 10. Studies on bushmeat in Ghana

In the 1990s , it was estimated that approximately 80 percent of animal protein consumed in Ghana was derived from wildlife including fish (Caspary, 1999). More recent research (Schulte-Herbruggen, Cowlishaw, Homewood, & Rowcliffe, 2013) showed that the consumption of bushmeat in Ghana "…[enables] households to spend 30 percent less on meat/fish purchases." The authors suggest that, despite heavily depleted wildlife and diversified livelihoods, bushmeat continues to play an important role in rural life by acting as a safety net for income supplementation and reducing household expenditures during times of economic hardship.

3.7 Cocoa[47]

Highlights

- Ebola disrupted the collection of the cocoa harvest at the farm level as well as transport for shipping, leading to post-harvest losses and affecting smallholders' access to imported rice (the cocoa and rice market chains are intertwined).
- The impact on the global cocoa market was minimal owing to the fact that Liberia, Sierra Leone and Guinea's contribution to global production is relatively small.
- The impact of Ebola on the income of smallholders involved in cocoa production in the affected countries points to the dramatic effects a similar epidemic or an expansion of the EVD outbreak could have in countries such as Côte d'Ivoire, which is highly dependent on cocoa production.
- Recommendations are related to the organization of a trade corridor to facilitate the collection of the cocoa production.

An important cash crop for smallholder farmers in the area

West Africa is a major area for cocoa production (accounting for two-thirds of world production), with Côte d'Ivoire, the world's top cocoa producer, accounting for 39 percent of global production (ECOWAS-SWAC & OECD, 2007).

The three main countries affected by Ebola – Liberia, Sierra Leone and Guinea – only account for 0.7 percent of global cocoa production (International Cocoa Organization). Nevertheless cocoa is an important product for smallholders' livelihoods in the three countries. A significant share of smallholders are involved in cocoa production (two to three million farmers produce cocoa in West Africa[48]) contributing from 84 to 95 percent of cocoa production depending on the country *(see Table 8)*. Cocoa is a cash crop that is easily accessible to smallholders as it has low input and labour requirements: it can generate an additional income of USD 1 000/year for a farmer investing 20 days of work per year, producing 500 kg of cocoa with no inputs (Bastide personal communication). Agro-industrial production is limited but is attracting growing international investment (mainly in Liberia since 2010) and provides income in rural areas (around USD 50/month for a non-skilled worker employed on a plantation).

The main cocoa production areas are the eastern districts of Kailahun, Kenema, and Kono in Sierra Leone; Lofa, Bong and Nimba counties in Liberia; and Forest Guinea. The production is exported to consumer countries. While production is dominated by smallholders, the high financial requirements to enter the cocoa trade exclude small traders from the business. Trade is in hands of big trade companies

47 Thanks to Ph. Batside and T. Ruf, Cirad.

48 According to Tim McCoy, spokesman for the World Cocoa Foundation, http://www.pennlive.com/midstate/index.ssf/2014/10/how_is_ebola_affecting_west_af.html

Table 8. Cocoa: Production and share of smallholder production in Côte d'Ivoire, Guinea, Liberia and Sierra Leone

Country of production	Production (1) (1 000 t/year)	Share of smallholder production (2) (%)
Côte d'Ivoire	1 600	98
Guinea	4	95
Liberia	8.5	85
Sierra Leone	11	84

Source: (1) ICCO and (2) Ph. Bastide, Cirad, personal communication

such as the African Coffee and Cocoa Company Limited or the Kailahun Produce Company in Sierra Leone, and Lebanese traders. Interestingly, in remote areas, *"the cocoa and imported rice market chains are tightly intertwined – the cocoa buyer is an imported rice seller, the cocoa seller is a rice buyer (…). Cocoa and rice are bought and sold from the same shops. As both markets are concentrated, the cocoa/rice traders wield a high degree of influence on [cocoa] producer food access"* (FEWS NET et al., 2010a). Regarding cross-border trade, the CFSAM report for Sierra Leone mentions that *"Although 2014 cocoa production is estimated to be normal, exports have fallen by 30 percent, according to a new report by "Welt Hunger Hilfe". The estimated drop in exports was driven by reduced cross-border trade and limited commodity inflow from neighbouring countries"* (FAO & WFP, 2014).

Cocoa trade strongly disrupted in affected countries, but with no lasting effect on the international market

Cocoa harvesting lasts for several months once or twice a year (ICCO). In Liberia, the mid-crop season takes place from April to September and the main crop season from September to April. A good production was expected for 2014 but the Ebola outbreak erupted in the main cocoa producing areas.

Labour shortages - due to sickness, people leaving the affected areas (up to 40 percent of people left cocoa areas in some specific areas according to FAO's rapid assessment report on Kailahun conducted in August 2014 and the World Bank [2014]) and the difficulties of gathering for collective work may have affected the harvest of the mid-crop season when the disease started, as well as post-production activities.

For the main crop season (starting in October in Liberia), group work largly resumed in Liberia and production is estimated to be normal (CFSAM) although Sierra Leone was hit with heavy rains in November 2014.

Most problems were caused by the disruption of trade activities. Purchase stores closed and there were few buyers due to traders' and drivers' fear or inability to access production areas (because of health measures such as quarantine and Ebola checkpoints) and to ship the production once collected. The mid-crop harvest – which represents 15 to 20 percent of the annual crop according to ICCO[49] – was not collected in many areas, and cocoa production and exports fell by approximately a quarter to a third in Guinea (CEA, 2014).

Traders' activities may also have been reduced due to limited access to funds because of bank closures, and traders who had pre-financed producers were not always reimbursed.

In this context, many producers were left with their production on hand. The absence of storage facilities/ warehouses led to high levels of post-harvest losses and reduced quality of the product. A few buyers came back after the beginning of the epidemic to buy production that was still marketable in terms of quality. Their low number was highly unfavourable to producers' bargaining power, who bartered cocoa for rice (as is regular practiced). Prices paid to producers were said to be low but no data is available. Considering that combined cocoa production in these three countries represents only about 0.7 percent of global output, the impact has been minor on the global cocoa market.

Nevertheless, international financial markets consider cocoa and gold to be the most *"at risk"* commodities in relation to Ebola (Deutsche Bank Analyst, Oct. 2014). This is independent of the sanitary quality of the product itself in relation to Ebola (the rapid qualitative risk assessment concludes that this risk is negligible, *see Annex 2*) but due to the fear that Ebola may reach major producer countries such as Côte d'Ivoire and Ghana or the countries providing labour (such as Mali and Burkina Faso for Ivoirian cocoa plantations). These fears led to a short-term price increase in April 2014 on the international market (+ 200 USD/t).

Conclusions and recommendations

The Ebola outbreak disrupted cocoa harvest collection from farms and transport for shipping, led to post-harvest losses and affected smallholders' income and access to imported rice. The impact has been minor on the global cocoa market owing to the minimal contribution of these three countries to global production.

Recommendations are related to the organization of a trade corridor to facilitate cross-border trade

49 http://www.icco.org/faq/58-cocoa-harvesting/131-what-time-of-year-is-cocoa-harvested.html

and ensure that harvested cocoa can reach shipping points for export to global markets.

Trade corridors in the context of Ebola need to be implemented through intersectoral cooperation between departments in charge of health, transport, agriculture and customs as well as cooperation between public and private sectors. At the international level, FAO, WHO, the International Organization for Migration (IOM) and the World Customs Organization (WCO) could be involved.

The IOM recommends in the context of Ebola that efforts are made to *"reinforce the capacity for controlling borders so as to facilitate their re-opening in accordance with the recommendations of ECOWAS Ministers of Health. Controlled opening of borders would allow trade and social exchanges between communities to be organized, thus re-creating official channels for exchange and reducing the use of clandestine channels, while increasing controls (in particular health controls) of passage. Sound planning remains essential and several options are available to organize reopening such as, for example, opening weekly local markets with organized and reinforced health and security measures, and/or the establishment of health cards for border residents allowing limited and controlled local exchanges, and/or the organization of 'controlled contact' trade exchanges facilitated by officials. Such measures call for sound preparation and coordination between the various actors, as well as a communication strategy to ensure that communities are informed and aware in a adapted and comprehensible manner"* (IOM, 2014).

Regarding shipping, recommendations issued on the Ebola Maritime Awareness collaborative website[50] should be adopted for international cocoa trade.

Clear messages should be communicated on how to maintain safe group work. Improved storage capacities in the long term will benefit the quality of local cocoa. To compensate income loss, interventions such as cash transfers should be considered.

Attention should be extended to neighbouring countries, which are highly exposed. Ebola's impact on the income of smallholders involved in cocoa production in the three affected countries should alert to the dramatic effects the epidemic could have in countries highly dependent on cocoa such as Côte d'Ivoire.

©FAO/Julien Gavelle

Summary of impacts on the different market chains

The following table presents a summary of the EVD outbreak's impacts on selected market chains; for each stage of the market chain, the impacts are categorized as low, medium or high.

The table shows that impacts of the EVD outbreak were mostly been felt at the marketing level and observed through changes in trade flows for all the selected market chains. Agricultural production was been disrupted and sometimes hit hard in areas strongly affected by the epidemic, but this impact was contained at the national level. The impacts on prices varied greatly from low to high depending on the market chain. The impacts on consumption were more closely related to the decrease in purchasing power due to the general economic downturn and falling producer prices than to massive price increases. However, data on these impacts remain scarce, especially in terms of substitution effects on food consumption.

The table shows also that some market chains were more strongly affected than others: the impacts on the potato and cocoa market chains are far stronger than for cassava, for example.

50 http://www.ebolamaritimeawareness.com/

Table 9. Summary of impacts on selected market chains

Impact on market chain	Rice	Potatoes (horticultural products)	Cassava	Palm oil	Domestic animal products	Cocoa	Bushmeat
Production	**Low** (at national level, medium in areas strongly affected)	**Low** High post-harvest losses	**Low**	**Low**	**Low** feed access transhumance	**Low** High post-harvest losses	**High** (commercial hunting)
Trade	**High** (for local rice, low for imported rice)	**High** (interrupted exports)	**Low**	**Medium** (regional, interna-tional trade)	**Medium** (cattle) to high (poultry, pork) impact on regional trade	**High** (interrupted trade)	**Very high**
Prices	**Low** (increase/decrease)	**High** decrease (financial losses for producers)	**Low**	**Low** (producers prices and consumers prices in main cities)	**High** on feed prices	High decrease	No data
Consumption	**Medium** (substitution due to lower purchasing power)	No impact	**Low** (substitute of rice)	No impact	**Medium** (loss of purchasing power)	N/A	**High** (urban area)

4. Recommendations

At the time of completing this report, cases were declining in all three countries and some EVD-related restriction measures were being lifted. Key issues included supporting agricultural trade flows and market chains towards recovery while maintaining efforts to counter the virus. General recommendations for all market chains are presented first, followed by specific recommendations for each market chain.

4.1 General recommendations

The general recommendations cover four areas. They aim at encouraging and supporting the recovery of activity in the agricultural market chains through:

1. **Establish safe trade corridors based on Public Health mitigation measures along market chain critical control points** (farm work, trade circuits and markets).

2. **Economic measures** that support the recovery of agricultural activity (support to input access, rescheduling loans, etc.).

3. **Additional research at the human-animal-ecosystem interface** on specific topics (the role of agricultural market chains in spreading the virus, stakeholders' adaptation strategies in an epidemic context, potential changes in consumption modes, etc.).

4. **Intersectoral political commitment** at the national and international level.

Public health measures

It is recommended that collaboration between Health and Agriculture departments be reinforced so that health measures contribute to overcoming the main bottlenecks in agricultural market chain function and trade flows due to the epidemiological context.

- **For farmers groups.** In areas where EVD prevalence is high, 'return to the farm' campaigns would need to be combined with EVD prevention campaigns. Information campaigns and increased rural access to hygiene kits (focused on urban areas until now) will help to ensure the safety of group farm work. Keeping a certain distance between workers and drinking from separate cups are examples of cautionary group work measures experimented during harvest in some counties in Liberia.

- **For trade roads and international borders.** Health checks on trade corridors are necessary surveillance measures to accompany the lifting of restriction measures. The protocol for such corridors should be based on WHO recommendations (Sept. 2014). For instance, a health check-point could be established on both sides of the border to allow health checks on drivers and possibly sanitary checks on commodities by the relevant health and agriculture agents before the usual customs controls. Clear instructions should also be provided to law enforcers informing them to give priority to the movement of food and commodities. In some cases, transporters prefer to transport perishable goods such as vegetables at night when the weather is cooler. They should not be restricted to daylight operations.

- **For marketplaces.** Re-opening key periodic markets requires intensive communication and sensitization activities for the various stakeholders using the marketplace. Moreover, market-places should be closed at night and disinfected once a week. These measures should be sustained even after the epidemic to counter health risks other than those linked to EVD.

Due to limited human and financial resources for health checks, key stakeholders in market chains should be mobilized: producer organizations, market authorities, transport unions, trade associations, agricultural extension agents, or any other trusted local structure. They should be recognized as key actors

in risk management rather than merely the targets of awareness-raising measures to ensure that messages conceived jointly are effective and acceptable. Market chain stakeholders should participate in intersectoral committees for Ebola control.

In the specific case of long-distance transport and trade, the implementation of health measures (e.g. temperature controls and truck disinfection) could be delegated to transport unions and organized along the lines of what has been done in the Abidjan-Lagos corridor for HIV/AIDS. Over shorter distances and for more informal channels (collectors, small traders), marketplaces should serve as relay points, distributing information and materials and establishing health protocols.

Economic measures

It is recommended that **incentives, guarantees and reassuring messages** are urgently provided for all market-chain actors. For smallholders in particular, there is a risk that drops in production will be sustained or even more marked in 2015 because several producers had difficulties selling their production or sold at a loss this past farming season. Farmers' decisions on the land areas to be sown will depend on their economic capacity, their confidence in being able to mobilize collective labour when required and guarantees that they will be able to market their produce at favourable prices.

Economic measures could therefore consist in **supporting smallholders through local purchases** for food aid and **support for agricultural inputs**. Farmers, particularly fruit and vegetable producers, need support to access inputs (seeds, tools, fertilizers, etc.) through subsidies, and to repay loans contracted during the previous farming season.

Additional research at the human-animal-ecosystem interface

The present impact assessment has revealed a number of information gaps in the understanding of EVD's impacts, particularly with regard to livelihoods and food and nutrition security. To contribute to filling these gaps, it is recommended that:

- **Further scientific studies** are undertaken for a better understanding of the risk of Ebola spillover at the human-animal-ecosystem interface.
- **Specific studies on individual and collective strategies** implemented by stakeholders to adapt to EVD and mitigate its effects are undertaken.
- **Specific studies on food consumption** due to changes in availability and prices are undertaken.
- **A seminar on the cocoa value chain** in West Africa (with FAO and Conseil Café Cacao) should be organized to alert to the dramatic effects that the epidemic could have in countries such as Côte d'Ivoire, which is highly dependent on cocoa.

Political commitment

- **Mobilize donors and regional policy makers.** While significant amounts of resources were allocated to containing the epidemic, it is recommended that governments and their partners invest in economic activities to boost national economies in the post-Ebola period.
- **Communicate technical recommendations at a high political level** and, in particular, bring them to the attention of regional integration organizations such as ECOWAS, MRU and WAEMU.
- **Ensure intersectoral coordination for supporting trade activities** in an epidemic context. At national levels, intersectoral coordination should involve departments of health, agriculture, trade, customs, transport and domestic security. At the international level, organizations such as WHO, IOM and WCO should collaborate with FAO and agree on the best way to implement health and economic measures.

4.2 Specific recommendations for market chains

Rice

- Farmers groups and marketing and trade flows at domestic and regional levels were affected by the restriction measures to limit the spread of the outbreak (bans on gatherings, closure of markets, etc.) as well as by farmers' and traders' fear behaviours.

- Health measures are recommended to encourage farmers to resume labour groups farming activities and traders to collect rice in production areas, as well measures to re-open key periodic markets that include health measures to reduce risk (information campaign, hygiene kits, disinfecting infrastructure, etc.).

Potatoes (and other horticultural products)

- The closure of the Senegal-Guinea border caused considerable post-harvest losses, falling producer prices and financial losses for producers.

- Recommendations are to accompany the re-opening of the Senegal-Guinea border with health checks on drivers to ensure a safe trade corridor. Economic measures are also necessary to support smallholders: local purchases for food aid, financial support to reimburse input loans and purchase inputs for the next season.

Cassava

- The impact of the EVD outbreak was limited because cassava is less labour intensive than rice, produced widely throughout the region and not perishable like potatoes. However, regional trade dynamics from Sierra Leone have been affected by border closures.

- Health checks and information should accompany the re-opening of borders to ensure safe trade corridors.

Palm oil

- Regional trade flows were particularly affected by the closure of cross-border markets, while domestic trade was less affected and the international market did not suffer from the temporary closure of industrial plantations.

©FEWS NET/Brenda Lazarus

- Main recommendations are therefore to re-open regional markets, e.g. Ganta market in Sierra Leone and to support producers in affected areas to market their palm oil production themselves.

Domestic animal products

- Animal products were affected by the decreased purchasing power of consumers, and, for the commercial poultry sector, by difficulties accessing imported animal feed

- The flow of animals from Mali via Guinea to Sierra Leone and Liberia was reduced. Similarly, the trade activity of livestock farmers in Forest Guinea to supply Liberia with pigs and poultry was hampered.

- Animal restocking should be targeted where bushmeat consumption was replaced by consumption of small livestock (e.g. Côte d'Ivoire), or where loss of income caused farm decapitalization (affected areas).

- Past projects, designed prior to the Ebola epidemic, to substitute bushmeat with other animal products to protect wildlife should be reformulated in light of the EVD experience.

Bushmeat

- Bushmeat plays a key economic and nutritional role in affected areas. Due to EVD, consumption fell, especially in urban areas, but without a significant substitution effect on other products.

- It is necessary to prepare and agree on suitable regulation and consistent communication to manage bushmeat activities in a post-Ebola context.

- Bans on hunting and bushmeat consumption could be focused on bats, wild mammals, wild antelopes and sick or dead wild animals.

- Communication on risks associated with bushmeat should also target children in rural areas.

Cocoa

- The EVD outbreak disrupted cocoa collection from farms and transport for shipping, led to post-harvest losses and affected smallholder access to imported rice. However, there was no impact on the global cocoa market due to the three countries' minimal contribution to global production.

- Recommendations concern organizing a trade corridor to facilitate collecting and transporting the cocoa production.

- The impact of Ebola on smallholder incomes should alert to the dramatic effects the epidemic could have in Côte d'Ivoire, which is highly dependent on cocoa.

©FAO/Jaward Keifa

5. Conclusions

Agricultural market chains and Ebola: strengthening resilience

The Ebola outbreak was caused by human-to-human transmission and although the disease does not represent a food-related risk, the epidemic has certainly had a strong impact on agricultural market chains.

We have examined the impact of Ebola through seven market chains (rice, cassava, horticultural products, palm oil, domestic animal products, bushmeat and cocoa) in Guinea, Sierra Leone and Liberia. An innovative and participatory approach such as this is of interest because it allows us to:

- Understand the mechanisms by which the Ebola risk, considered *"systemic"*, affects other sectors of economic and social life (beyond merely the health sector) and highlights societies' vulnerabilities.

- Elucidate and link some of the economic impact indicators produced by FAO and other national or international institutions.

- Reveal the reactions and new interactions between economic stakeholders within these market chains to show how they adapt to the epidemic context, and thus analyse the resilience mechanisms of agricultural market chains.

The Ebola epidemic disrupted the functioning of regional agricultural market chains. Agricultural production was affected (FAO-WFP have estimated an average reduction of 12 percent of production volumes for staple crops) by difficulties linked to the reduced availability of labour due to illness and restrictions on mobility. However, above all, it affected the possibility of collecting and transporting agricultural production to consumption areas. This disruption was linked to collectors' reluctance to travel to contaminated zones (the number of traders decreased by 20 percent according to WFP) and to a lesser extent to transport difficulties arising from *"Ebola checkpoints"*, *"quarantine zones"*, and the closure of certain borders.

These obstacles contributed to reducing farmers' incomes (higher costs of inputs and lower negotiating power with collectors whose numbers decreased) and to modifying normal price *"models"* (geographical and seasonal patterns), thus establishing a context of instability and uncertainty for stakeholders within these chains, from producers to consumers. Consumer price increases were limited by the low purchasing power of an already poor population, weakened even further by the global economic slowdown. Some prices fell – e.g. potatoes in Guinea (whose potato exports to Senegal were blocked) or rice in the Kambia region in Sierra Leone (which normally exports to Guinea).

Because of lack of investment capacity or lack of confidence in the marketing possibilities for their products at acceptable prices, there was concern that producers would reduce their activities in 2015 (thus increasing food insecurity) even if it was confirmed that the epidemic was receding. The number of food insecure individuals due to Ebola was estimated in the hundreds of thousands in each country and was expected to rise in 2015 (FAO& WFP, 2015; FAO & WFP CFSAM 2014).

Over the longer term, it is important to learn lessons from this epidemic, especially since emerging diseases specialists believe that such epidemics will increase in frequency and gravity. Some market chains absorbed the shock of the crisis better than others and were more efficient in contributing, directly or indirectly, to food access for the most fragile households. The Ebola epidemic can teach us what this efficiency is based on, i.e. the resilience as well as the vulnerabilities of a market chain from the point of view of its contribution to food security in a context of a systemic crisis.

Faced with the absence of collectors, better organized producers were able to market their products themselves in consumption zones. With the closure of local markets, some sellers opted to become street vendors. The consumption of imported rice partly decreased in favour of local tubers, and bushmeat

in favour of fish or meat from domesticated animals. New regional trade circuits were used: through Mali to bypass the closure of the Senegal-Guinea border or by boat along the coasts to bypass the re-routing of shipping lanes. Thanks to their financial capacity, social networks and, more generally, their capacity for speculation, some stakeholders were able to benefit from increased price differentials between production zones affected by the epidemic and consumption zones.

However, other economic stakeholders within these market chains, mostly without storage capacities and with weak negotiating power, were hit by restrictions. The most affected were stakeholders in long market chains (cocoa versus cassava), more labour- and input-intensive chains (poultry versus fish or cassava), chains with weak market diversification (cocoa versus palm oil), chains involving perishable products (potato versus cassava) and chains employing salaried labour (industrial cocoa versus rice).

The bushmeat market chain is also considered key in this crisis since it could be the source of spillover events. Even if such spillovers can be viewed as rare events, their consequences are nonetheless disastrous. This sector represents an important safety net from a nutritional and economic as well as cultural point of view, and a means of controlling pests that damage crops. Ebola has affected the bushmeat market chain, but it is likely that apart from a lasting effect on the consumption of certain species (bats, non-human primates) and animals found dead, stakeholders will return to their previous activity. The fight against poaching is costly and not very effective; it is thus essential that beyond the ban hurriedly implemented during the crisis, the broader scientific community reflects on realistic and proportionate measures to establish during such an epidemic using an intersectoral approach that takes into consideration the market chain's environmental, health, food, economic and cultural aspects.

This study also had a special emphasis on local rice market chain since local rice is essential to the region's food security. It is also emblematic of the epidemic's consequences on agricultural market chains, both upstream and downstream. Production was disrupted by illness, bans on gatherings, restrictions on the movement of people and the workers' fear of going to their fields because of Ebola. These factors affected group farm work. Domestic trade flows that normally go from rice production areas, particularly hit by the epidemic, to consumption areas were disrupted by restrictions on people's movement and goods within the three countries. At the regional level, stakeholders in Sierra Leone's local rice market chain also faced difficulties exporting parboiled rice to Guinea. Rice imports, which were not significantly affected by the epidemic, were able to make up the deficit in local production, but this came with the disadvantage of increasing the three countries' import dependence and national expenditure on food.

The challenge of systemic crises in a globalized world

Ebola is a systemic risk. Using OECD terminology (OECD, 2003), this is a risk that affects the systems on which society depends (health, transport, environment, telecommunications, etc.) and requires a systemic response, which is a new policy approach to risk management that includes developing synergies between public and private sectors; informing and involving stakeholders and the general public; strengthening international co-operation; and making better use of technological potential to improve research efforts.

The latest Ebola epidemic has taken on new proportions due to the greater connectedness of space and increased movement of goods and people within the region. It illustrates the intensity of the spread of a virus in a globalized, interconnected world. Chain effects highlight the increasing interdependence of geographic and economic spaces. These spaces can no longer close themselves off to ensure their own security because isolation would only make them more fragile. The market chains covered in this study are regional and international market chains. Manpower, inputs, funds/capital and products are all moving along the value chain. The challenge is therefore to isolate the disease without isolating, and thus rendering fragile, what one seeks to protect. This is a growing problem in a globalized world, obliging us to rethink the coordination of an increasingly vast network of actors. At the same time, this challenge also offers new opportunities to develop new forms of solidarity.

Annex 1. Bibliography

Adefalu, L. L., Oladipo, F. O., Usman, B. A., Babalola, F. D., Amusa, O. O., & Egere, S. (2012). Rural Women Perception on Bushmeat Trade around Kainji Lake National Park, Niger State, Nigeria. *Ethiopian Journal of Environmental Studies and Management, 5* (1).

Anstey, S. (1991). *Wildlife utilisation in Liberia. the findings a national survey 1989-1990*. Gland: WWF/ FDA Wildlife survey report.

ATP. (2012). Trade Data Study - West Africa: Côte d'Ivoire and Guinea (pp. 115 pages): USAID.

Bahuchet, S. (2000). *Les peuples des forêts tropicale aujourd'hui.* Bruxelle: APFT.

Baize, S., Pannetier, D., Oestereich, L., Rieger, T., Koivogui, L., Magassouba, N., Gunther, S. (2014). Emergence of Zaire Ebola virus disease in Guinea. *N Engl J Med, 371*(15), 1418-1425. doi: 10.1056/ NEJMoa1404505

Bank, W. (2014c). Update on the Economic Impact of the 2014 Ebola Epidemic on Liberia, Sierra Leone, and Guinea (pp. 10 pages): World Bank.

Bene, J.-C. K., Gamys, J., & Dufour, S. (2013). Marketing channel of hunting products in northern Nimba County, Liberia. *Livestock Research for Rural Development, 25* (1).

Bouchet-Saulnier, F. (2000). L'accès aux victimes : principe humanitaire ou slogan politique ? (pp. 13): Medecins sans frontières.

Brugiere, D., & Magassouba, B. (2009). Pattern and sustainability of the bushmeat trade in the Haut Niger National Park, Republic of Guinea. *African Journal of Ecology, 47* (4), 630-639. doi: 10.1111/j.1365-2028.2008.01013.x

Caspary, H.-U. (1999). *Utilisation de la faune sauvage en Côte d'Ivoire et Afrique de l'Ouest. Potentiels et contraintes pour la coopération au développement* (Vol. F-V/10f). Eschborn: TOB Publication.

CEA. (2014). Incidences socio-économiques de la maladie à virus Ebola en Afrique (dec 2014) (pp. 94). Addis-Abeba, Éthiopie: Nations Unies.

Chaber, A. L., Allebone-Webb, S., Lignereux, Y., Cunningham, A. A., & Rowcliffe, J. M. (2010). The scale of illegal meat importation from Africa to Europe via Paris. *Conservation Letters*, 3(5), 317-323. doi: 10.1111/j.1755-263X.2010.00121.x

Crookes, D. J., & Milner-Gulland, E. J. (2006). Wildlife and economic policies affecting the bushmeat trade: a framework for analysis. *South African Journal of Wildlife Research*, 36(2), 159-165.

Damania, R., & Bulte, E. H. (2007). The economics of wildlife farming and endangered species conservation. Ecological Economics, 62(3-4), 461-472. doi: 10.1016/j.ecolecon.2006.07.007

Davies, G., Schulte-Herbruggen, B., Kumpel, N. F., & Mendelson, S. (2007). Hunting and Trapping in Gola Forests, South-eastern Sierra Leone: Bushmeat from Farm, Fallow and Forest. In G. Davies & D. Brown (Eds.), *Bushmeat and Livelihoods: Wildlife Management and Poverty Reduction* (pp. 15-31). Oxford: Blackwell Science Publ.

Dufour, S. (2013). Etude de la chasse et de la filière gibier dans le corridor du Chem de fer - Projet SIMANDOU/Rio Tinto Rapport final. Rio Tinto - Simfer S.A.

ECOWAS-SWAC, & OECD. (2007). Le Cacao. Atlas de l'integration regional en Afrique de l'Ouest. série economie.

FAO-PAM-Guinée. (2014). Evaluation rapide d 'limapct de la maladie à virus Ebola sur l'agriculture et la sécurité alimentaire en Guinée (pp. 46 pages): FAO-PAM-République de Guinée.

FAO-Sierra Leone. (2014a). The Food Security Situation in the context of Ebola Outbreak in Sierra Leone. A Rapid Assessment Report (pp. 27 pages): Ministry of of Agriculture, Forestry and Food Security (MAFFS), FAO.

FAO-Sierra Leone. (2014b). Selected Agribusiness Value Chain Case Studies On the Effects of Ebola on the Agriculture Sector, 13-17 September, 2014 (pp. 8): FAO.

FAO-WFP-Guinea. (2014). FAO/WFP Crop and Food Security Assessment -Guinea (pp. 29 pages): FAO/WFP.

FAO-WFP-Liberia (2014a, 13 November 2014). [Rapid Assessment key findings in Liberia (impacts of Ebola on Food Security)].

FAO. (2015 b). (Plee, L.) Addressing Zaire Ebola virus outbreaks. Rapid Qualitative Exposure and Release Assessment. FAO/AGAH Technical Report. February 2015.: FAO AGAH.

FAO. (2015a). Bonwitt, J. et al. FAO Mission report. Bushmeat value chain analysis in EVD context. (pp. 14): FAO.

FAO, & WFP. (2014). Crop and Food Security assessment -CFSA-SIERRA LEONE (4 dec 2014).

Fargeot, C. (2013). *La chasse commerciale en Afrique centrale: Une menace pour la biodivdersité ou une activité économique durable? Le cas de la république Centrafricaine.* (Thèse de doctorat), Univ. Paul Valery, Montpellier.

FARM (2014, 30 septembre 2014). [Interview de Monsieur Moussa PARA DIALLO].

FEWS NET. (2013). GUINEA Production and Market Flow Map Report.

FEWS NET. (2014). *GUINEA, LIBERIA AND SIERRA LEONE* special Report (sept).

FEWS NET. (2014a). *Ebola-related fears disrupt markets and livelihoods; elevated levels of food insecurity expected Guinea, Liberia and Sierra Leone Special Report* (pp. 6 pages): FEWS NET.

FEWS NET (2014b). [Projected Food Security Impacts of Ebola in Guinea, Liberia and Sierra Leone].

FEWS NET, CILSS, FAO, & WFP. (2010a). Cross border trade and food security. Liberia Sierra Leone.

FEWS NET, CILSS, FAO, & WFP. (2010b). Cross border trade and food security. The Western Basin: Gambia, Guinea, Guinea-Bissau, Mali, Mauritania, Senegal.

Gire, S. K., Goba, A., Andersen, K. G., Sealfon, R. S., Park, D. J., Kanneh, L., Sabeti, P. C. (2014). Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak. Science, 345(6202), 1369-1372. doi: 10.1126/science.1259657

Gret. (2014). Pauvreté et faim : les autres victimes d'Ebola en Guinée. *Politiques et pratiques de développement* (N°16), 4 pages.

Hoyt, R. A. (2004). Wild Meat Harvest and Trade in Liberia: managing biodiversity, aconomic and social impacts. *ODI Wildlife Policy briefing*, 6.

IGC. (2014a). The Economic Impact of Ebola: Monitoring the Impact of Potential Transport Disruptions on Traders, Food Availability, and Market Prices.

IGC, LSE, & University of Oxford. (2014). The Economic Impact of Ebola: – September 2014 Report. Monitoring the Impact of Potential Transport Disruptions on Traders, Food Availability, and Market Prices (pp. 8): (International growth center).

IOM. (2014). Mission exploratoire des besoins aux frontières du Sénégal avec la Guinée dans le cadre de l'épidémie de Maladie à Virus Ebola - Région de Kédougou.

IUFoST. (2014 (Nov.). Ebola virus disease (EVD): Important aspects for the food science and technology community *Scientific Information Bulletin (SIB):* International Union of Food Science and Technology.

Jannot, C. (2014). Les filières oléagineuses en Afrique de l'Ouest et du Centre: le grand retour du palmier à huile. In C. Demeter (Ed.), *Démeter 2014* (pp. 247-312): Paris, .

Josserand, H. P. (2013). *Evaluation des volumes et de la valeurs des échanges intrarégionaux.* Paper presented at the "Libre circulation des produits alimentaires", Accra.

Le Breton, M., Prosser, A. T., Tamoufe, U., Sateren, W., Mpoudi-Ngole, E., Diffo, J. L. D., Wolfe, N. D. (2006). Patterns of bushmeat hunting and perceptions of disease risk among central African communities. *Animal Conservation, 9* (4), 357-363. doi: 10.1111/j.1469-1795.2006.00030.x

Le Coz-Broutin. (2009). Convergences et conflits d'intérêt entre les paysans et les consommateurs : l'exemple de la Guinée. Peut-on surmonter les conflits et renforcer les convergences ? (pp. 77 pages): Gret, CFSI, CNOSC, MAEE, AFD, Mairie de Paris.

Ministère de l'agriculture, G. (2014). Enquête Nationale de la Sécurité Alimentaire et de la Vulnérabilité (ENSAV) - Données de juin /juillet 2012 (pp. 41 pages): PAM.

Ministère de la santé et de l'action sociale, S. (2014). Plan de renforcement des capacités requises pour l'application du RSI au niveau des points d'entré au Sénéagl Republique du Sénégal.

Nasi, R., Taber, A., & Van Vliet, N. (2011). Empty forests, empty stomachs? Bushmeat and livelihoods in the Congo and Amazon Basins. International Forestry Review, 13(3), 355-368.

Ntiamoa-Baidu, Y. (1997). Wildlife and food security in Africa. FAO CONSERVATION GUIDE (Vol. 33). Roma: FAO.

OECD. (2003). Emerging Systemic Risks in the 21st Century: An Agenda for Action (pp. 290): OCDE.

PNUD (2014, Septembre 2014). [Evaluation d'impact socio-économique de l'épidémie de fièvre Ebola en Guinée. Rapport à mi-parcours et prochaines étapes].

Rafflegeau, S. (2014). Les palmeraies dites naturelles, un particularisme de l'agriculture familiale en Afrique de l'Ouest. In M. Sourisseau (Ed.), *Agricultures familiales et mondes à venir.* (pp. 141-142). Versailles: Quae.

Schulte-Herbruggen, B., Cowlishaw, G., Homewood, K., & Rowcliffe, J. M. (2013). The Importance of Bushmeat in the Livelihoods of West African Cash-Crop Farmers Living in a Faunally-Depleted Landscape. *Plos One, 8* (8). doi: 10.1371/journal.pone. 0072807

Subramanian, M. (2012). Zoonotic Disease Risk and the Bushmeat Trade: Assessing Awareness Among Hunters and Traders in Sierra Leone. Ecohealth, 9(4), 471-482. doi: 10.1007/s10393-012-0807-1.

Sy, M. A. (2002). Etude sur la filière artisanale de l'huile de palme en Guinée PASAL-BCPEA.

Tailliez, B. (2007). Le palmier à huile dans l'agriculture familiale et la réduction de la pauvreté: CIRAD.

UNDP. (2015). Socio-economic Impact of Ebola Virus Disease in West Africa - A Draft Report (UNDP ed., pp. 73 pages): UNDP.

UNECA. (2014). Les incidences socio-économiques de la Maladie à Virus Ebola (MVE) en Afrique (pp. 94 pages): UNECA.

USAID. (2012). Trade Data Study - West Africa. Côte d'Ivoire and Guinea. Expanded Agriculture Trade Promotion Project/Agriculture Trade Promotion Project.

WFP CILSS-FEWS NET. (2010). Cross border trade and food security. Liberia Sierra Leone (pp. 29 pages): WFP, CILSS, FEWS NET.

WFP Guinée. (2010). Enquête Nationale de Sécurité Alimentaire (ENSA) : documents de synthèse. Guinée (pp. 25 pages): WFP.

WFP Liberia. (2010). The State of Food and Nutrition Insecurity in Liberia. Comprehensive Food Security and Nutrition Survey *Comprehensive Food Security and Vulnerability Survey* (pp. 153 pages): WFP, Government of Liberia.

WFP Liberia. (2011). Impacts of Rising Food - Fuel Prices and Refugee Influx in Liberia - Emergency Food Security and Market Assessment, Data collected between April-May 2011.

WFP. (2014b). South Senegal: Ebola Trade Impact - Rapid Assessment in Diaoube and Kedougou *Mission Report.*

WFP. (2014c (sept)). West and Central Africa, Markets update: Special Issue on the Ebola Outbreak *Special Bulletin*: WFP.

WFP. (2014e). How can we estimate the impact of Ebola on food security in Guinea, Liberia and Sierra Leone? : WFP.

WFP mVAM Guinée. (2014). Guinée Octobre 2014: Un indice de stratégies de survie élevé en Guinée Forestière *Bulletin spécial mVAM* (Vol. #2, pp. 3 pages): WFP.

WFP mVAM Liberia. (2014). Liberia - Households in the central zone are using severe coping strategies *Special mVAM Bulletin* (Vol. #3, pp. 4 pages).

WFP mVAM regional. (2014). Guinea, Liberia and Sierra Leone, Food insecurity remains high in spite of the harvest *Special mVAM Regional Bulletin #1: November 2014.*

WFP mVAM Sierra Leone. (2014). Sierra Leone - September 2014: higher coping in the Ebola-affected districts of Kailahun and Kenema *Special mVAM Bulletin* (Vol. #1, pp. 4 pages): WFP.

WHO. (2015). Ebola Response Roadmap Situation Report (pp. 15 pages): WHO.

World Bank. (2014). The Economic Impact of the 2014 Ebola Epidemic (September 2014 Report). Short and Medium Term Estimates for Guinea, Liberia, and Sierra Leone. (pp. 29).

World Bank. (2014a). The Economic Impact of the 2014 Ebola Epidemic: Short and Medium Term Estimates for Guinea, Liberia, and Sierra Leone (pp. 29 pages): The World Bank.

World Bank. (2014b). The Economic Impact of the 2014 Ebola Epidemic: Short and Medium Term Estimates for West Africa (pp. 71 pages): World Bank.

Ziegler, S. (1996). Une première analyse de la chasse dans le parc national du Haut Niger. *Nature et Faune* (FAO/PNUE), 12(4), 13-29.

Annex 2. Rapid Qualitative Risk Assessment for agricultural products in Ebola-affected countries

Authors: Helen Roberts, Lindsey McCrickard, Jesse Bonwitt

This assessment was prepared during and following the FAO technical workshop on the market chain of agricultural products affected by the Ebola crisis in Dakar, Senegal, in December 2014.

1. Introduction

Several international agencies have carried out risk assessments of the introduction of disease through consumption of meat from wild animals (CDC, WHO, FSA, ECDC/EFSA). These assessments are driven by the understanding that imports of such meat are illegal and the volume of trade is very low in comparison to other products. Meat from wild animals is considered a higher risk for transmitting not only the Ebola pathogen, but others as well. The animals from which the meat is derived may be reservoirs (asymptomatic) or could have been infected at the time of hunting; the lack of veterinary checks or animal husbandry (for domestic animals and farmed wildlife) for such animals makes it very difficult to apply safe hygiene rules. These risk assessments conclude that while there is still considerable uncertainty about Ebola infection in wildlife, there is a significant risk for people who hunt, slaughter, butcher and consume the animals, particularly fruit bats, non-human primates and forest duikers and especially if sick or dead animals are consumed.

The following risk assessment will consider the risk associated with products other than meat from wild animals, namely animal products (derived from pigs and poultry) and cash crops including fruits and vegetables.

Unlike an import risk assessment (according to OIE guidelines), where the product is considered infected or contaminated from the start of the risk pathway, this assessment will consider the change in risk not only throughout the production process (as with a food safety risk assessment, CODEX guidelines) but also along the entire market chain. This relatively new methodology of market chain analysis allows the risk to be assessed for potential product contamination at any stage of the market chain (FAO, 2011).

2. Hazard identification

Ebola virus (Zaire strain): The reservoir host for Ebola viruses is not confirmed, but is considered likely to be the fruit bat (possibly *Hypsignathusmonstrosus, Epomopsfranqueti* and/or *Myonycteristorquata*). Other animals (mammals), notably non-human primates and humans, can be infected and act as virus "propagators" through increased viral shedding. Virus can be excreted in vomitus, faeces, urine, blood and less commonly (only in severely affected patients) saliva, while semen is the last body fluid to be cleared of virus once the patient recovers.

Field studies on Ebola virus are scarce and while meta-analysis has been used to gather the evidence of susceptibility to infection for different species, it is still unclear which animals serve as vectors for zoonotic transmission and which act as dead-end spillovers (Olson et al, 2012). Experimentally, several species can be infected with Ebola virus: horses, pigs, guinea pigs, mice, rats and goats. However, only pigs have been experimentally shown to be capable of transmitting the disease to other mammals (Weingartl et al, 2012). No other species (avian, reptile, fish, insect or plant) have been found infected, either experimentally or in a field situation (Leroy, 2004).

The relevance of the observation that dogs may develop a seropositive reaction following close contact with infected humans or animals has been assessed

elsewhere (EFSA 2014). Dogs cannot be entirely ruled out as being involved in transmission because they have been found to undergo serological conversion; nevertheless they are considered not to be implicated in viral ecology during human outbreaks (Allela et al, 2005).

Characteristics of Ebola virus suggest that survival of the virus on surfaces is less than a few days, and that survival is reduced in both dry conditions and when exposed to direct sunlight (Piercy et al, 2010). Survival in meat products (fresh or frozen) could be up to several days (fresh) or several weeks (frozen). Smoking or drying the meat product may reduce the survival of virus but will not completely mitigate the risk. Heat treatment (for example, during the canning process or for at least 1 hour at 60oC) will destroy the virus. The virus is inactivated by contact with common household disinfectants (bleach, chlorine, hydrogen peroxide).

3. Assumptions

- Certain species of fruit bats, which are found throughout the affected countries, are considered reservoir hosts.

- The highest risk for transmission is contact with a symptomatic human (one showing symptoms of disease).

- Aerosol transmission is not a transmission route for Ebola virus between humans.

- Fomite transmission may be possible where there is a high level of environmental contamination through contact with burial grounds, hospital waste or contact with infected, raw bushmeat.

- Consumption of fruit bats and meat from any wild animals found sick or dead (bushmeat) is still considered a risk in affected regions and should be avoided.

- The incubation period is (for 95 percent of cases) 2-21 days (and can occasionally be as long as 45 days). Clinical progression of the disease typically ranges from relative mild symptoms (flu-like illness) in the first one to two days, then at days 4-7, symptoms such as diarrhoea, vomiting, headaches and days 7-10, severe symptoms such as shock, bleeding and coma leading to death. The mortality rate in the current outbreak is approximately 50 percent and survivors do not generally develop the symptoms associated with severe clinical disease (days 7-10). The early signs of EBOV disease are similar to so many other endemic diseases including malaria and diarrhoea that general awareness raising of the population is crucial for early diagnosis.

WHO (2014) Five keys to safer food:

- Keep clean
- Separate raw and cooked
- Cook thoroughly
- Keep food at safe temperatures
- Use safe water when possible and raw materials

In addition, the following should also be taken into account:

- Separate raw meat from other products, including fruit, vegetables and other commodities.

- Do not allow the packaging or commodity to come into contact with a sick person and prevent a sick person from travelling in the same transport as the commodity.

- Disinfect packaging where possible with household disinfectants (spray with chlorine [bleach]) if there is any indication of contact with a sick person.

- Wash or peel fruit and vegetables.

However, in certain resource-poor settings such as rural and urban areas in West Africa, these behaviours and activities are not always possible.

In the unlikely event that any consignment of interest has been in contact with a symptomatic person infected with Ebola, there is a very low risk this could cross-contaminate one of the handlers, transporters or traders at market. Safe hygiene measures (hand disinfectant, hand washing etc.) will mitigate this very low risk. To avoid infected people entering the non-affected country while driving consignments of products, for example potatoes, trucks should pass through a control point and health checks could be carried out. However, it is possible for someone to be incubating the disease without showing clinical signs[51], and because the possibility of carrying out

51 The likelihood of someone being infected and not exhibiting clinical signs depends upon the prevalence of disease in the population, the time since infection, incubation period and the time of the journey. Taken together, the likelihood of someone being infected and not showing clinical symptoms during the journey is considered low.

a full clinical examination of transporters is not feasible due to resource constraints, it should be noted that the traceability of people entering non-affected countries presents a considerable challenge but unloading consignments at borders to prevent the entry of people is detrimental to the quality of the products and increases marketing costs.

4. Risk levels

EFSA /OIE qualitative risk level terminology will be used. For further details of these terms and estimates of uncertainties, *see the table below.*

5. Products under consideration

While agricultural trade in West Africa involves many products, this risk assessment addresses six key commodities that represent the main food groups as well as the different market chains involved: rice, potatoes, cocoa, palm oil, mangoes, animals and animal-related products. There is more than one market chain for each commodity, so only the most common have been addressed. For animals and animal-related products, only two species will be covered here (pigs and poultry).

Virus survival depends on time, temperature and exposure to sunlight. To prevent the commodities from spoiling, many may be transported at night when temperatures are lower and thus virus survival may be expected to be longer. The infective dose is only known under experimental conditions and therefore the reduction in infective dose along the market chain cannot be estimated with great confidence; nevertheless, product contamination level will depend on the origin of contamination (bat faeces and urine, human faeces, vomitus or blood or contact with fresh blood or meat from infected animals).

6. Market chains

Diagrams were drawn up during the December 2014 workshop. They are part of the risk pathway analysis, the second step in risk analysis (FAO, 2011). With a full risk assessment, more detail would be included to cover all the key players in the value or market chain: producers and traders; market organizations; veterinary services where important; movement and marketing infrastructure, etc. For brevity, only the outline of such groups has been included in the risk assessment. The risk assessment considers the following questions and identifies where in the market chain these could occur:

- Can a disease agent enter here? (source, route)
- Can a disease agent survive here? (conditions, treatments)
- Would a disease agent be noticed here? (surveillance)
- Can a disease agent be carried out from here? (destination, route)

The coloured boxes correspond to the different risk levels – green represents negligible risk; blue represents the entry route where potential contamination from contact with symptomatic people could occur; red represents steps in the chain where contamination could occur and where the pathogen could potentially be found in the product concerned.

6.1 Rice [Imported]

See the following market chain figure

Rice is imported to affected countries from non-affected countries. In this scenario, the rice is of negligible risk of already being contaminated with Ebola virus. The risk enters the market chain only once the product enters the affected country via possible contact with Ebola-infected and clinically-ill people at

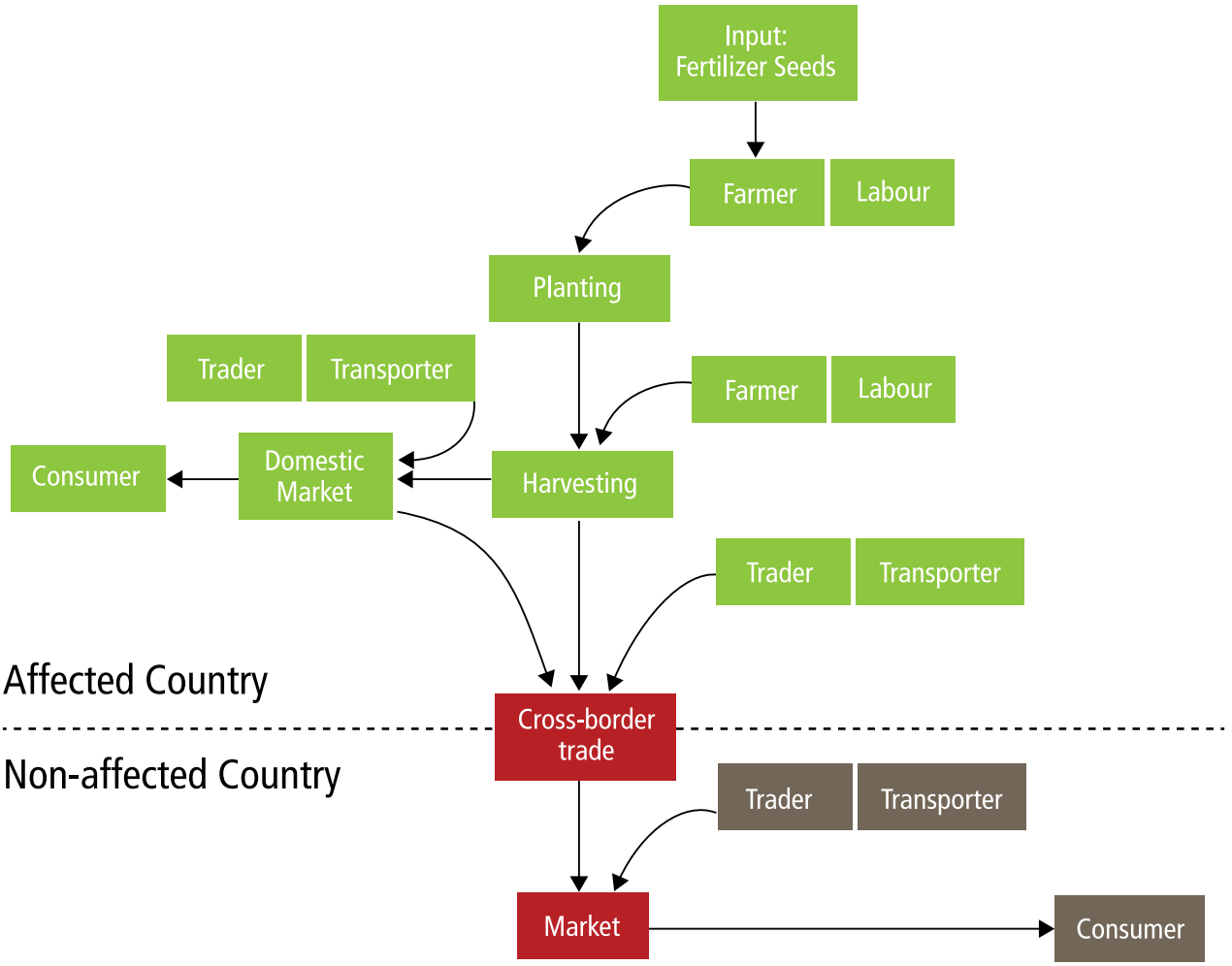
Level	Terminology
Negligible	So rare it can be excluded
Very Low	Very rare but cannot be excluded
Low	Rare but should be considered
Medium	As likely to occur as not
High	Very likely to occur
Very High	Almost certainly occurs

the market and involved in the product's transport. The risk is for packaging to become contaminated and the virus surviving long enough during transport to cross-contaminate the handler or consumer. The likelihood of this occurring is very low and significantly less than the risk posed to the consumer or handler through contact with an infected person. Therefore, as long as people are taking safe health measures such as regular hand washing, the risk is negligible. Another potential route for contamination is from infected fruit bats in the country of origin contaminating the product packaging. There is considerable uncertainty about the background prevalence of Ebola in other fruit bat populations, and this is thought to be a similar risk level as any contamination of the packaging occurring along the market chain.

In terms of the risk of the transporter crossing the border and returning to the un-affected country of origin, the risk is from the human-to-human contact, which may occur during the time spent in the affected country. It is not possible to monitor people for the time spent in the affected country due to lack of resources. Therefore the risk for this person contracting Ebola while in the affected country is the same as for any person in that country and depends upon the level of contact with a symptomatic or convalescent person. This risk level is low (rare but does occur[52]) and could be mitigated by safe health measures.

For movement of consignments between affected countries, the same level of care should be taken when handling products. This would represent a different market chain but would be similar to that described below for commercial mangoes.

52 In Liberia, 8 362 cases in a population of 4.3 million is a prevalence of less than 0.2 percent. Assuming significant under-reporting, at a case rate of less than 1 in 100, this is considered a low level if IPCC risk estimates are used – see Table 1 in Annex.



6.2 Potatoes [locally produced]

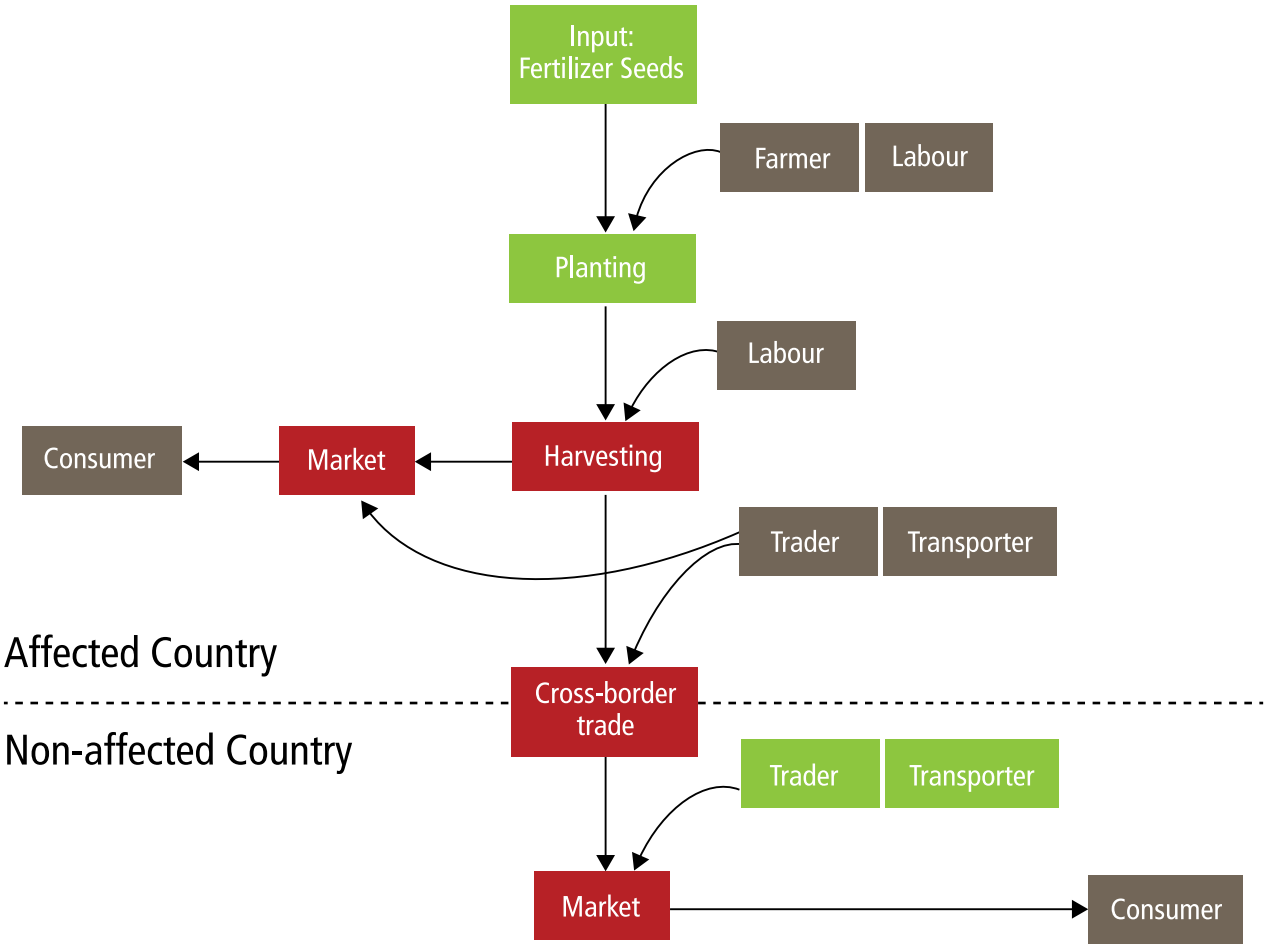
See the market chain figure below

Plants, fruits and vegetables are unlikely to become infected with Ebola virus (Swanepoel, 1995). For vegetables grown underground, the only risk to human health is through the product's contamination after contact with an infected person, infected meat or contaminated equipment, nightsoil (where human waste is collected for fertilizer) or other waste material. Potatoes sown and planted in an affected country are of negligible risk to farm workers, particularly in comparison with the risk of contact between farm workers themselves. All farm workers should be made aware of the clinical signs for Ebola so that if a worker falls ill, measures are taken to ensure that the ill person does not work with others. Along the market chain itself, there is a very low likelihood that potatoes would become contaminated, and then only through contact with a clinically-ill person or infected products. The virus survival in such a situation will depend on the time taken to reach the market, temperature and storage conditions. Packaging may become contaminated under the same circumstances.

6.3 Rice [locally produced]

See the market chain figure below

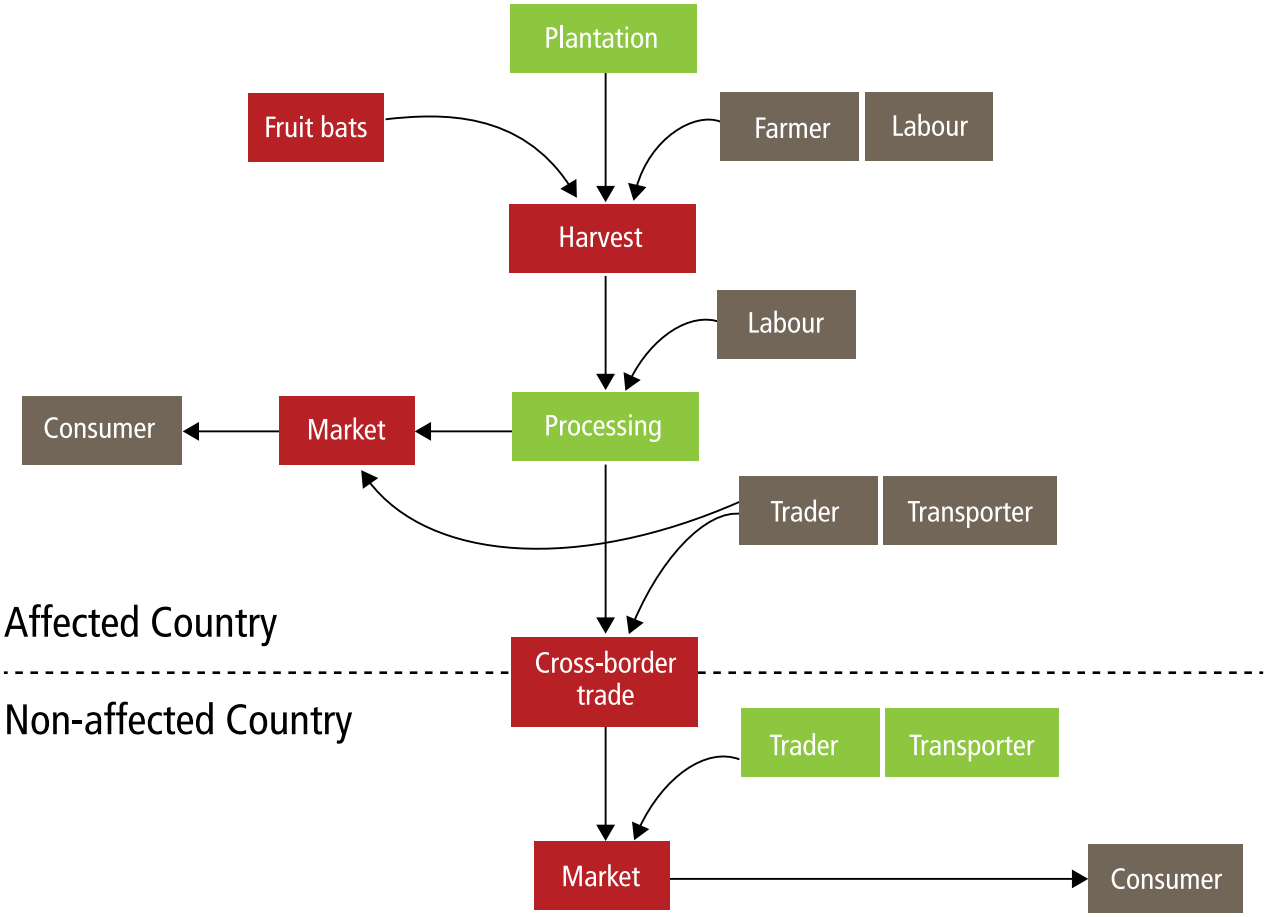
For locally-produced rice, which is the main rice consumed in Guinea and Sierra Leone, the market chain is essentially similar to that for potatoes and the issues are the same. The risk is from product contamination during harvesting and transport.



6.4 Cocoa

See the market chain figure below

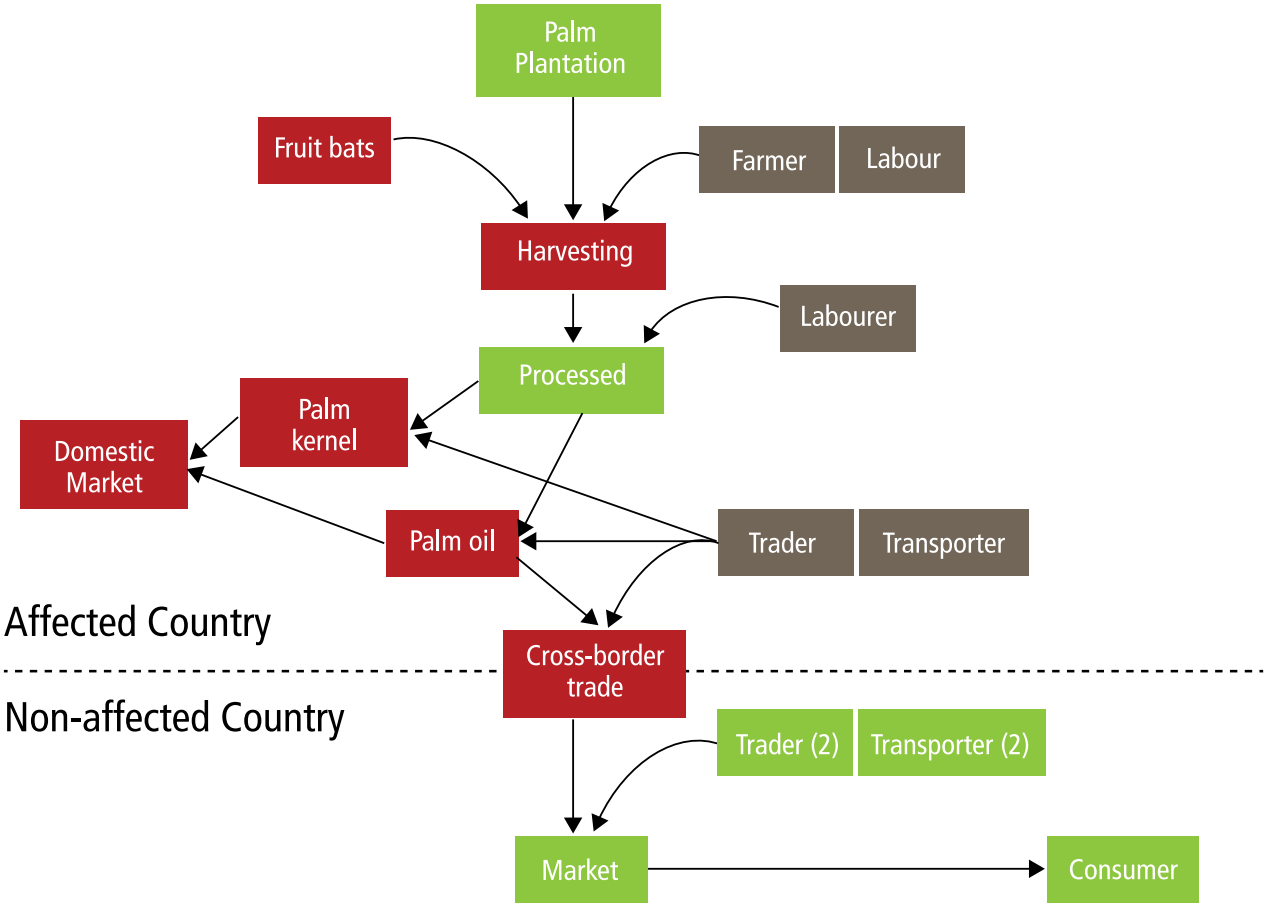
Cocoa harvesting and processing in West African countries that have only artisanal production involves manual labour. Even the large commercial producers in Côte d'Ivoire require significant levels of manual labour, often immigrant workers from neighbouring countries. As with palm oil, any risk for the product comes from contamination. Fruit bats could be roosting in plantations and therefore contaminated faeces or urine may drop onto the cocoa pods. There may be a risk of contact for the worker with the product, but this is considered very low if not negligible, as the risk for becoming infected requires consumption not simply contact, because the viral load is expected to be far lower in bat faeces than in infected human excretions or secretions. During the processing chain, the outer husk of the cocoa pod is removed, so any residual risk is from contact with clinically-infected people working at the processing stage. Further risk of contamination, as for all these products, is from contact with people along the market chain and the likely survival of virus under storage conditions.



6.5 Palm Oil

See the market chain figure below

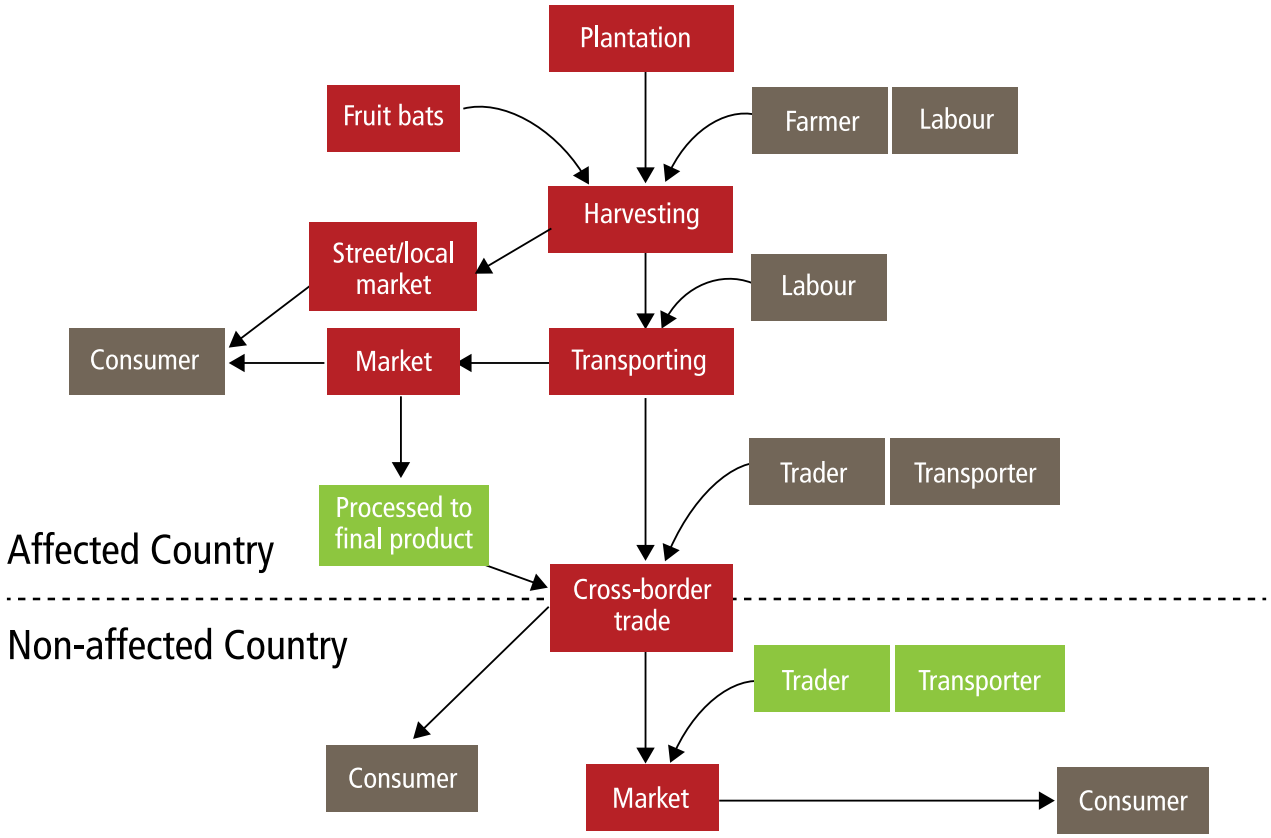
There is a very low risk that infected fruit bats are present in the region where palm oil is being produced and that surface contamination could occur through bats' defecating on the palm fruit. Once harvested, palm fruit are processed to remove the hard shell and press the kernel to produce oil and palm extract or kernel cake for animal feed. Therefore, the likelihood of the virus surviving beyond the processing steps is considered negligible. Once processed and packaged, the risk arises from contact with symptomatic infected people contaminating the product or packaging. Final risk of the product is therefore dependent upon transport times and conditions. If transport takes several days, the likely survival of virus is reduced.



6.6 Mangoes

See the market chain figure below

The risks along the mango market chain are similar to the risks identified along the cocoa market chain. Any risk for the product is from contamination along the market chain either from human excreta or bats. In mango plantations, there is a risk that fruit bats contaminate mangos through faeces or saliva during consumption. This risk can be considered low, with potential transmission of the Ebola virus to farm labourers or those who directly consume the freshly-harvested mangoes without washing them. During the mangoes' transport, the survival time will depend on the transport method (refrigerated trucks will increase survival while direct sunlight decreases survival). If the mangoes are processed into another product such as juice or jam prior to transport to a non-affected country, the risk can be considered negligible. The same issues and mitigation actions can be used as for the transport of potatoes, as described above.

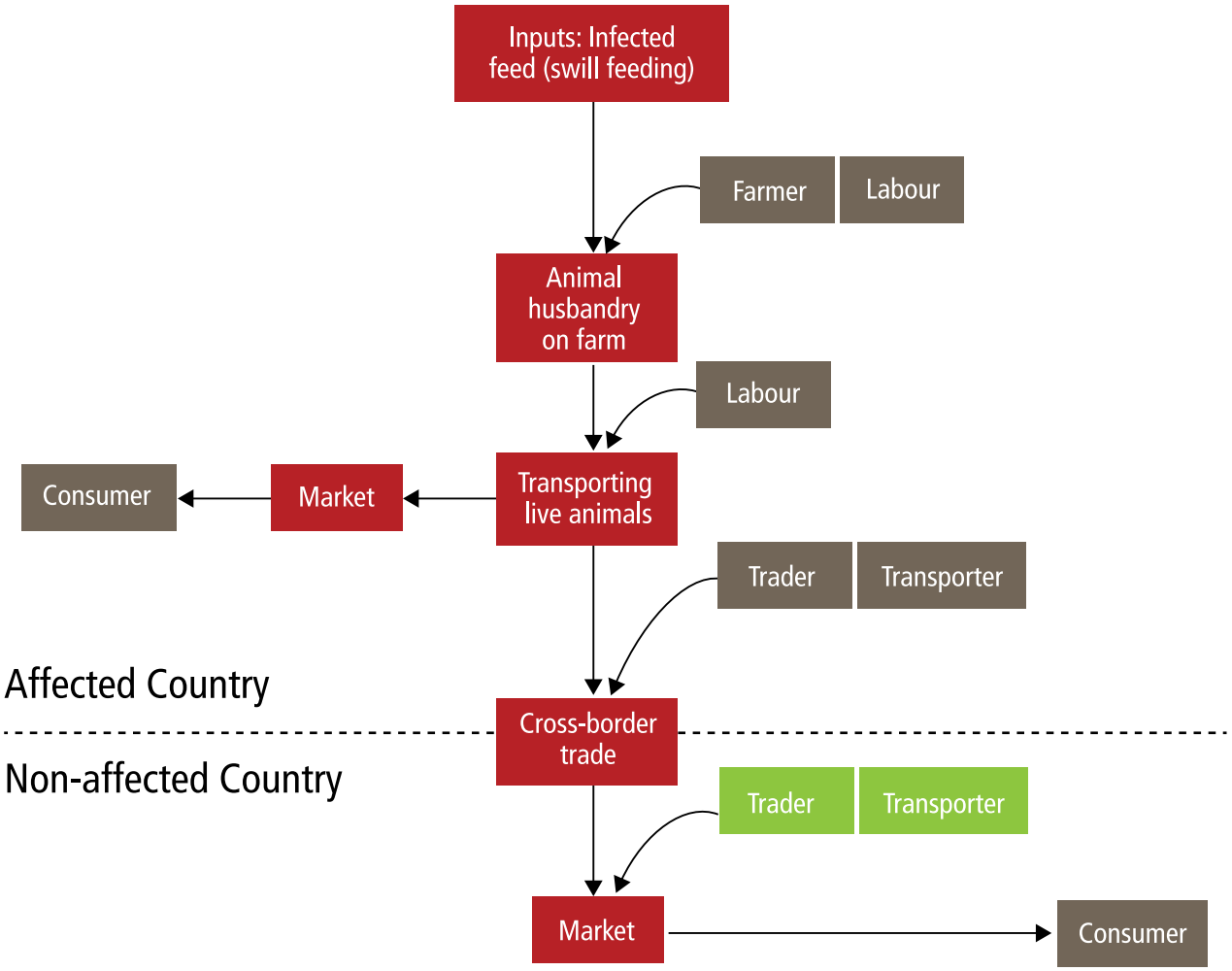


6.7 Pig and pig products

See the market chain figure below

Pigs have been experimentally infected with Ebola virus and shown to be capable of transmitting the disease to other co-confined animals in a laboratory situation. There is no evidence to suggest they are involved in the epidemiology of disease outbreaks in countries where Ebola is present (ILRAD, 2013). Nevertheless, the experimental evidence means this cannot be entirely excluded.

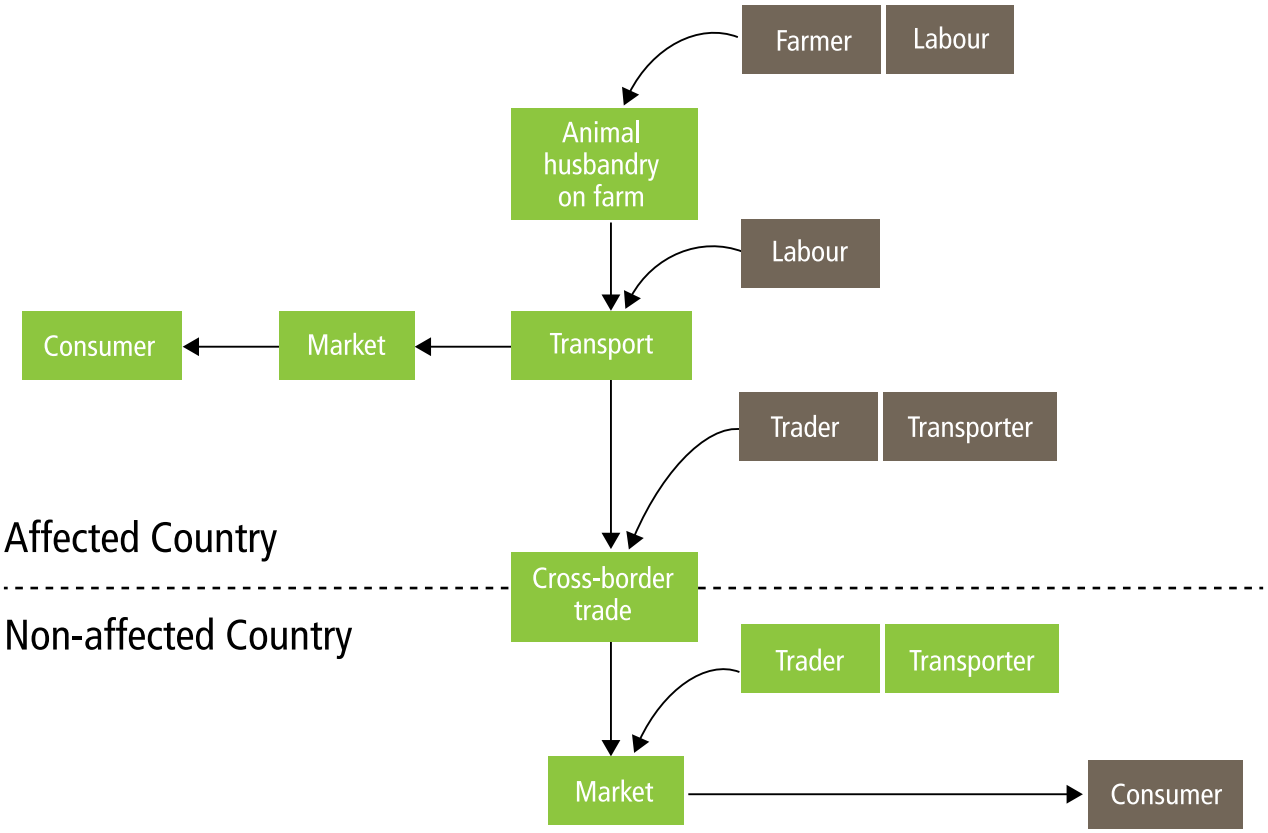
If pigs were in contact with infected products such as bushmeat, fruit bats or with infected symptomatic people, they could potentially become infected. However, they are understood to develop clinical signs within several days when they are capable of transmitting disease through aerosol contact. As pigs are transported as live animals, they should not be moved nor enter into the food chain if they are showing clinical signs. This is the basis behind all OIE agreements for trade in live animals and WTO agreements for animals entering the food chain. A veterinary inspection and isolation period prior to transport would mitigate any risk.



6.8 Poultry and poultry products

See the market chain figure below

Poultry and other avian species have not been shown to be susceptible to Ebola virus and none has tested positive in the field. Therefore, they are not considered to be infectious at any stage. While there could potentially be some contamination of birds through contact with clinically-infected humans, it is thought to be a very low risk. Processing of products (slaughtering, preparing carcasses, cooking) would mitigate any risk. Therefore, contact with farm workers, transporters and slaughterhouse workers, in the very unlikely event that they were clinically symptomatic, is not believed to pose a risk.



7. Final Risk Estimates

Commodity	Risk of contamination / infection at origin	Further processing before market or border?	Risk of contamination through contact with symptomatic person	Final risk of product being contaminated
Rice (Imported)	Negligible	Only transport	Very low	Negligible if conditions not suitable for virus survival
Rice (locally produced)	Very low	Yes	Very low	Negligible if conditions not suitable for virus survival
Potatoes (locally produced)	Very low	Only transport	Very low	Negligible if conditions not suitable for virus survival
Cocoa	Very low	Yes	Very low (negligible if cocoa is processed in unaffected country)	Negligible if conditions not suitable for virus survival
Palm Oil	Very low	Yes	Very low	Negligible if conditions not suitable for virus survival
Mangoes	Very low	Only transport	Very low	Very low for non-commercial trade; negligible for commercial trade if processed
Products of Animal Origin - pigs	Very low	Only transport	Very low	Very low with no controls; negligible with correct veterinary checks and isolation
Products of Animal Origin – other including poultry	Negligible	Only transport	Very low	Negligible
Products of animal origin – meat of wild animals	Medium (High if sick or dead animals are collected)	Only transport	Very low	Non-negligible (depends on species of animal and the survival of virus and length of journey)

Overall level of confidence in this assessment is satisfactory although for some evidence, namely actual prevalence of disease in wild animals including fruit bats, survival time of the virus in agricultural packaging and the infection of pigs with Ebola, it is unsatisfactory (i.e. further information would strengthen confidence but could lead to a change in risk level).

8. Conclusions

The market chains used for the purposes of the workshop covered the main agricultural categories: products grown above ground and therefore at risk of contamination from fruit bats or other infected reservoir hosts; products grown below ground, which are only at risk from contamination once harvested and during the marketing and transport processes; products from animals that are not susceptible to Ebola virus infection and; products from animals that are susceptible to Ebola virus infection. These products may be destined for local markets or the international market or imported from non-affected countries.

Harvesting, transport and processing is carried out by workers who are generally considered fit for work and therefore not symptomatic with Ebola virus disease. This does not entirely preclude the possibility of contact with an infected person, but with the poor environmental survival of Ebola virus outside an infected body or fluid, the risk is very low, if not negligible.

Therefore, the risk assessment concludes that provided there is no contact with symptomatic infected

people during any stage of the market chain, there is negligible risk of transmitting Ebola virus in most of these products.

Two products remain of slight concern, firstly, the local market-production of mangoes or other fruit that could be contaminated on the surface with bat faeces or other infected body fluid. Because these may be sold locally, the time between harvesting and selling may be shorter than the environmental survival of EBOV and fruit may be eaten directly and not processed or cooked.

The second product of concern is pigs. As there is experimental evidence for pigs being infected and able to transmit disease, including via the aerosol route, care should be taken that pigs are not exposed to symptomatic human cases. In the event of infection, pigs are expected to show severe clinical signs and therefore a period of quarantine before trading the animals and a veterinary certification that the animals are in good health will mitigate the risk.

9. References

Allela, L., Bourry, O., Pouillot, R., Delicat, A., Yaba, P., Kumulungui, B., Rouquet, P., Gonzalez, J.P. and Leroy, E.M. (2005) Ebola virus antibody prevalence in dogs and human risk. Emerging Infectious Diseases 11: 385-390

Atherstone, C., Roesel, K. & Grace, D. (2013) Ebola risk assessment in the pig value chain in Uganda. ILRI Research Report 34. Nairobi, Kenya: International Livestock Research Institute. ISBN 92-9146-350-7

EFSA (2014) An update on the risk of transmission of Ebola virus (EBOV) via the food chain. EFSA Journal 12: 3884.

ECDC & EFSA (2014) Risk related to household pets in contact with Ebola cases in humans. EFSA Journal 12:3930.

FAO (2011) A value chain approach to animal diseases risk management. Food and Agriculture Organization of the United Nations, Rome.ISBN 978-92-5-106861-8

Leroy, E.M., Rouquet, P., Formenty, P., Souquiere, S., Kilbourne, A., Froment, J-M., Bermejo, M., Smit, S., Karesh, W., Swanepoel, R., Zaki, S.R. & Rollin, P.E. (2004) Multiple Ebola virus transmission events and rapid decline of Central African wildlife. Science. 303: 387-390.

Olson, S.H., Reed, P., Cameron, K.N., Ssebide, B.J., Johnson, C.K., Morse, S.S., Karesh, W.B., Mazet, J.A.K. &Joly, D.O. (2012) Dead or alive: animal sampling during Ebola haemorrhagic fever outbreaks in humans. Emerging Health Threats 5: 9134 DOI: 10.3402/ehtj.v5i0.9134.

Piercy, T.J., Smither, S.J., Steward, J.A., Eastaugh, L & Lever, M.S. (2010) The survival of filoviruses in liquids, on solid substrates and in a dynamic aerosol. J ApplMicrobiol. 109: 1531-1539.

Weingartl, H.M., Embury-Hyatt, C., Nfon, C., Leung, A., Smith, G. &Kobinger, G. (2012) Transmission of Ebola virus from pigs to non-human primates. Scientific Reports. 2: 811 DOI: 10.1038/srep00811

World Bank (2014) Population data. http://data.World Bank.org/indicator/SP.POP.TOTL

10. Additional information

Table 10. Definitions for qualitative risk terms based on EFSA (2006) and OIE (2004) with expanded descriptions adapted from NHS (2008), IPCC (2005), and Kahn et al., (1999)

Risk level	Definition	Expanded description
Negligible	Event is so rare, does not merit consideration	The chance of the event occurring is so small it does not merit consideration in practical terms (i.e. < 0.1% probability); it is not expected to happen for years;
Very low	Event is very rare, but cannot be excluded	The event is not expected to occur (very rare) but it is possible (i.e. >0.1-1% probability); it is expected to occur at least annually
Low	Event is rare, but does occur	The event may occur occasionally (rare) (i.e. >1-10% probability); expected to occur at least monthly
Medium	Event occurs regularly	The event occurs regularly (i.e. >10-66% probability); expected to occur at least fortnightly
High	Event occurs very often	The event will happen more often than not (i.e. ≥66-90% probability); expected to occur at least weekly
Very high	Event occurs almost certainly	The event will undoubtedly happen (i.e. >90% probability); expected to occur at least daily

Table 11. Definitions for the level of confidence in the risk estimate given the evidence used; based on definitions from EFSA, 2006; ECDC, 2011, Spiegelhalter & Riesch, 2011

Level of confidence	Definition
Unsatisfactory	Further research very likely to have impact on confidence of information and likely to change assessment
Satisfactory	Further research likely to have impact on confidence of information and may change assessment
Good	Further research unlikely to change confidence in the information

EFSA Scientific Committee (2012) Scientific Opinion on Risk Assessment Terminology. *EFSA Journal*, 10(5):2664.

European Centre for Disease Prevention and Control (2011) Operational guidance on rapid risk assessment methodology. Stockholm: ECDC.

Kahn, S., Wilson, D., Perera, R., Hayder, H., & Gerrity, S (1999). Import risk analysis on live ornamental finfish. Australian Quarantine and Inspection Service.

NHS (2008) A risk matrix for risk managers. Available at: http://www.npsa.nhs.uk/nrls/improvingpatientsafety/patient-safety-tools-and-guidance/risk-assessment-guides/risk-matrix-for-risk-managers/

OIE (2004) Handbook on import risk analysis for animals and animal products: Introduction and qualitative risk analysis. Paris: Office International des Epizooties.

Spiegelhalter, D.J. & Riesch, H. (2011) Don't know, can't know: embracing deeper uncertainties when analysing risks. Phil. Trans. Royal Society A (369) 4730-4750.

Annex 3. Summary of conclusions and recommendations

Main conclusions from the impact assessment

.

1. A relatively limited impact on agriculture production:

- **Production was affected by labour shortages** (due to illness, restrictions on gatherings, movements of people, etc.) for products such as rice that rely on farmers' groups for planting and harvesting. However, the decrease in national rice production was contained (drops between 4 and 12 percent) thanks to the increased use of family labour. This has been further described in the FAO/WFP CFSAM impact assessment studies. http://www.fao.org/3/a-i4311e.pdf

2. Severe disruption of market chains due to movement restrictions and the fear factor

- Although the **risk of transmitting the Ebola virus via food products** (except for bushmeat) **is negligible**, as shown by the rapid qualitative risk management assessment, certain market chains have been severely affected by EVD. **The major disruption of market chains because of EVD was largely due to difficulties collecting and trading** agricultural products.

- **Emerging regional markets activity was also disrupted** (rice, palm oil cassava and animal products).

- The disease **increased the price differential** between production and consumption areas.

3. A major impact on income generation and purchasing power

- **There was an overall loss of household income and purchasing power.** This is related to the difficulties in trading farm production but also to a broader decline in economic activity. Some indicators show an adaptation of food systems to changes in purchasing power and food item availability (e.g. rice substituted with cassava).

- Restriction measures and traders' fear of collecting production in affected areas reduced producer incomes. **Lower producer prices** were reported for rice, potatoes and cocoa because of the difficulty selling surpluses, significant post-harvest losses and producers' lower negotiating power owing to fewer traders. **Higher production costs** could not translated into higher sales prices given consumers' lower purchasing power because of job and income losses. This reduced producers' economic margins and raises concerns about their investment capacity and confidence for planting for the next season.

- **Traders with less financial and social capital have also suffered** from restriction measures.

Main recommendations

General recommendations:

- **Establish safe trade corridors based on Public Health mitigation measures along market chains:** information campaigns, hygiene kits and sanitary controls are essential to support farmer group activities and regulate the re-opening of borders and markets. All stakeholders (producer organizations, market authorities, transport unions, trade associations, agricultural extension agents, etc.) represent key actors in this risk management. Incentives, guarantees and reassuring messages for all market-chain actors are required.

- **Boosting economic and agricultural related activities.** Smallholder farmers could benefit from local purchases for food aid and financial support for agricultural inputs to encourage planting for the next season.

- **Disease surveillance and response at the human-animal-ecosystem interface:** the risk of Ebola spillover at the human-animal-ecosystem interface, market-chain actors' adaptation strategies and changes in food consumption need to be further explored. Multidisciplinary approaches to disease emergence and intersectoral coordination must be put into place at local, subnational and national levels.

Specific recommendations for market chains are as follows:

- **Rice:** develop and communicate on health prevention measures to encourage farmer group activity and traders to collect rice in production areas, and to encourage and monitor the re-opening of key periodic markets.

- P**otatoes (and other horticultural products):** support the re-opening of the Senegal-Guinea border with health checks and support smallholders in reimbursing input loans and purchasing inputs for the next season.

- **Cassava:** support the re-opening of cross-border markets with health checks and information to ensure safe trade corridors.

- **Palm oil:** re-open regional markets, e.g. Ganta market in Sierra Leone and support producers in affected areas to market their palm oil production themselves.

- **Cocoa:** organize a trade corridor in order to facilitate the collection and transport of the cocoa production and raise awareness of the effects the epidemic could have in Côte d'Ivoire (highly dependent on cocoa). A seminar on cocoa in West Africa would also be useful to reflect on the impacts the epidemic could have in countries such as Côte d'Ivoire

- **Bushmeat:** prepare and agree on suitable regulation and consistent communication to manage bushmeat activities in a post-Ebola context; focus bans on hunting and bushmeat consumption on specific species (bats, wild mammalian species, wild antelopes and sick or dead wild animals); and target children in rural areas in order to communicate the risks associated with bushmeat.

- **Other animal products:** encourage animal restocking where bushmeat consumption has been replaced by consumption of small livestock (e.g. Côte d'Ivoire), or where loss of income has caused farm decapitalization.

Annex 4. Ebola virus characteristics

Type of Virus: Filovirus, Ebolavirus (Zaire)

Reservoir: Unknown (fruit bats cannot be excluded)

Secreted in: Blood (mainly), faeces, vomitus, (saliva, semen, breast milk, tears cannot be excluded but less important role). Virus does not spread via airborne transmission.

Incubation Period: 2-21 Days

Clinical Signs and Viral Shedding: Sudden onset of fever, fatigue, headache and sore throat. Followed by period of vomiting, diarrhoea and impaired liver and kidney function. In some cases rashes form and/or bleeding occurs. Humans are not infectious until severe clinical signs manifest.

Chemical Inactivation:
Sensitive to common household disinfectants
3% Acetic Acid
1% Glutaraldehyde
Alcohol-Based Products
1:10 dilution of 5.25% household bleach
(10 minutes)

Physical Inactivation:
5 minutes at boiling temperatures
30-60 minutes at 60 degrees C
Gamma irradiation combined with 1% glutaraldehyde

Survival Outside Host:
Blood: weeks
In the dark under ambient conditions for around 20 hours
Dried in tissue culture for 50 days in 4 degrees C (note: not inactivated by refrigeration/freezing)

Animals shown to be infected by virus via serology: note – role in transmission is unknown.

Primates (clinical signs and high mortality); Bats (no clinical signs, no mortality); Antelopes (possible spillover exposure); Duikers (possible spillover exposure); Porcupines (possible spillover exposure); Dogs (possible spillover exposure); Rodents (experimental evidence only); Pigs (Experimental evidence only)

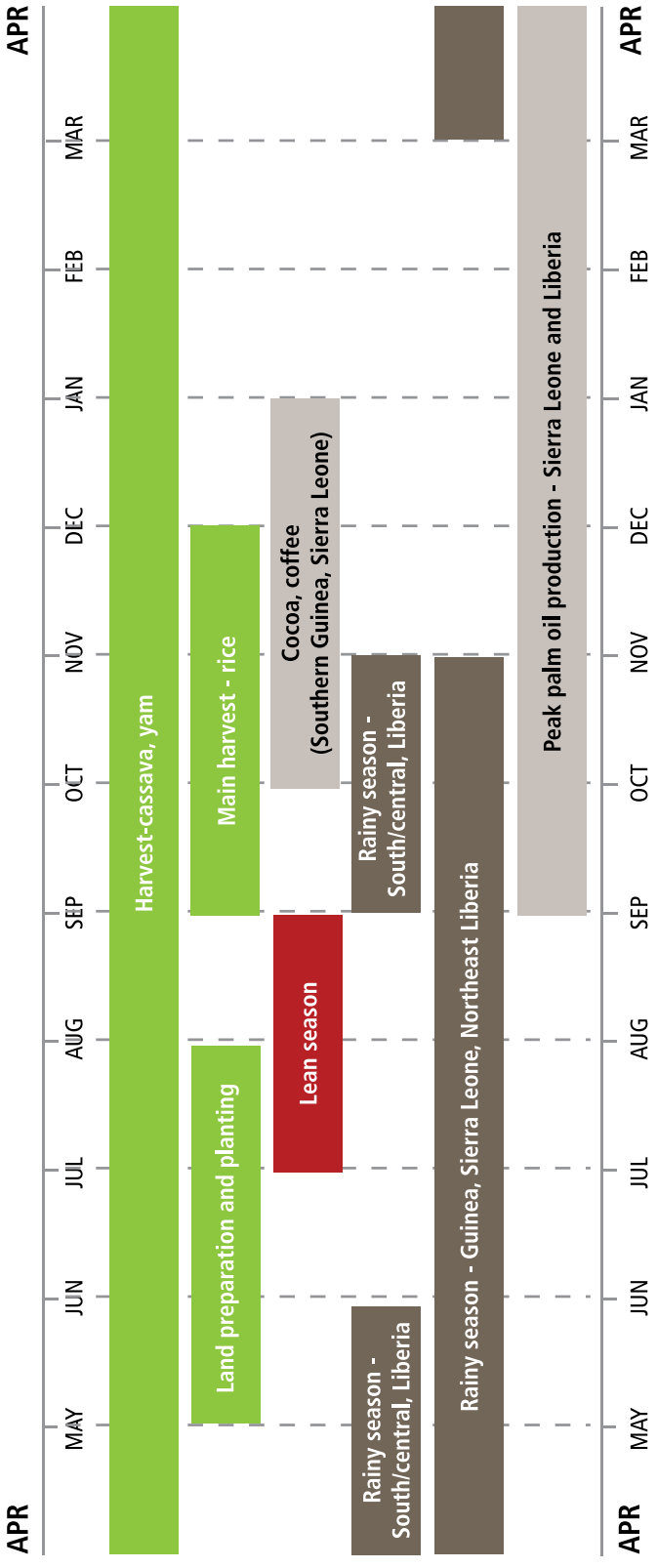
References:

CDC. "Review of human-to-human transmission of Ebolavirus." Available at: http://www.cdc.gov/vhf/ebola/transmission/human-transmission.html

Public Health Agency of Canada. "Pathogen Safety Data Sheet-Infectious Substances."Ebola. Available at: http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/ebola-eng.php

WHO "Ebola Virus Disease Fact Sheet" September 2014. Available at: http://www.who.int/mediacentre/factsheets/fs103/en/

Annex 5. Crop calendar



Source: FEWS NET 2014

Annex 6. Concept of corridors

Ebola trade corridors

Agricultural market chains have been severely disrupted by movement restrictions applying to goods and people: establishment of cordons sanitaires around quarantine zones, Ebola checkpoints, closure of markets and closure of international borders. Restoring, even partially, the functioning of agricultural market chains is a critical factor to minimize the indirect effects of the [Ebola] epidemic by protecting food security and maintaining economic activity in the affected zones and within the wider region.

According to the rapid qualitative risk assessment, product safety is not a major concern regarding Ebola; the major risk of contamination and propagation along the market chain is related to the movement and gathering of the chains' stakeholders (producers, handlers, traders, end-buyers). Therefore, addressing risks along the market chain requires a focus on human health issues when people gather (for collective field work or at marketplaces) and during transport, in particular for-cross border transport. The latter issue is addressed here through the recommendation of establishing or at least facilitating the functioning of trade corridors.

Trade corridors, in a context of epidemics such as Ebola, need to rely on sanitary controls on main trade roads (Ebola checkpoints) as is done in Liberia or at cross-border points (corridors could be implemented between Senegal and Guinea or between Liberia and Guinea). Ebola checkpoints are a necessary measure to control the spread of the disease, but farmers and traders perceive these checkpoints as barriers to trade. It is possible to maintain rigorous checks and ease farmers' and transporters' fears at the same time through safe healthy trade corridors.
When crossing borders or cordons sanitaires, a zone could be established on either side of the border or cordon to allow sanitary controls on drivers and possibly commodities by the relevant officials (health and agriculture officials in charge of phytosanitary controls) before the usual customs controls (for border crossing).

Clear instructions should also be provided to law enforcers, particularly at checkpoints and borders, instructing them to give priority to the movement of food and commodities. In some cases, transporters prefer to transport perishable goods (e.g. vegetables) at night when the weather is cooler. These traders should not be restricted to daylight operations but the checkpoint mechanism should be adjusted to accommodate this schedule.

Corridors may also be subject to illegal barriers and illicit charges or other road harassment (see Border Alliance road governance reports). These elements must be taken into account when studying the feasibility of developing health checks on main trade roads. Regular monitoring and evaluation of such corridors should be also planned so that they can be constantly adapted in the rapidly-evolving context of a crisis.

Implementing Ebola trade corridors should be considered as a medium-term response to the Ebola outbreak. However, in the long term, tools should be developed to address safety issues in relation to regional trade as a whole, rather than producing regulations and tools specific to each sanitary issue.

Regulatory tools available for implementing safe trade corridors

The protocol for organising Ebola trade corridors needs to focus on market-chain stakeholders. International Health Regulation (IHR 2005) and WHO guidance on *"Ebola event management at points of entry"*[53] could be adapted for the transport of agricultural products, and would be useful to mitigate the risk related to local and regional trade (the major concern of this study).

In response to the Ebola epidemic, Mali has organized health checks on its border with Guinea. Sene-

53 http://www.who.int/csr/resources/publications/ebola/event-management-poe/en/

gal, like several other countries, has also established EVD surveillance guidelines for border areas (see below) and a plan for capacity building necessary for implementing IHR at points of entry. However, these checks are costly and difficult to maintain in the long term and illustrate the difficulties in implementing IHR in countries with limited resources.

For overland posts (which are the main points for regional trade of merchandise), Senegal estimates the cost of its three-year action plan to be FCFA 48.9 million, with an additional cost of FCFA 61.8 million for each land border post (Ministère de la santé et de l'action sociale, 2014).

Other measures such as those adopted by port authorities (available on http://www.ebolamaritime-awareness.com/) could be adapted for terrestrial trade.

RÉPUBLIQUE DU SÉNÉGAL
Un Peuple – Un but – Une foi

MINISTÈRE DE LA SANTE
ET DE L'ACTION SOCIALE

DIRECTION DE LA PREVENTION

FICHE TECNIQUNE EBOLA N° 5, version du 25 septembre 2014

DIRECTIVES DE SURVEILLANCE DE LA MALADIE A VIRUS EBOLA AU NIVEAU DES FRONTIERES

Si un voyageur provient d'un pays en épidémie (ou transit / escale dans les 22 jours): vérifier par l'interrogatoire et un thermomètre :

a. s'il a de la fièvre;

b. s'il présente trois (3) symptômes ou plus parmi celles qui sont listées sur une fiche de suivi des sujets contacts

1. Si l'une de ces conditions au moins est positive : on le considère comme ***un "cas suspect"*** et déclencher les procédures prévues (isolement, lavage des mains de tous les contacts, information du médecin chef de district ou du médecin responsable de zone...);
2. Dans le cas contraire :

a. remplir la fiche d'identification sanitaire

b. Informer le passager de la nécessité d'un suivi de 21 jours depuis la date d'entrée au niveau de sa zone de destination

c. Il doit se présenter au niveau de la structure de santé de sa zone de résidence dès le lendemain pour les modalités de suivi; le cas échéant une relance sera faite par le district

d. La fiche sanitaire sera saisie sur la maquette prévue à cet effet et transmise chaque jour au district, région et niveau central

e. Le niveau central fera le tri en fonction des régions de destination et transmet la liste aux régions concernées

f. La région fera le tri en fonction des districts de destination et transmet la liste aux districts concernées

g. Les districts procèderont aux suivis et transmettent les informations quotidiennement au niveau supérieur

The concepts of trade, health and humanitarian corridors

Implementing Ebola trade corridors or securing existing trade routes to re-establish safe trade with a humanitarian/food security objective could be based on past experiences of implementing or developing trade, health and humanitarian corridors.

Trade corridor

The concept of a trade corridor originates from initiatives aimed at enhancing trade access (by road, air and sea) as a means of development. They are modelled on the ancient silk route in Asia. In Van Pelt et al. (2003) they are defined as follows: *"Trade corridors[54] are streams of products, services, and information moving within and through communities in geographic patterns according to a matrix"*. The World Bank has developed tools for improving the performance of existing trade corridors and for *"overcoming local barriers to global connectivity"*.

In West Africa, several initiatives resemble this concept. For example, the *"USAID West Africa Trade Hub (WATH)[55]"* project, which aims to establish *"good road governance"* (notably within the limitations of ineffective controls and corruption) and supports a partnership of public and private actors as part of a *"borderless alliance"*. Every three months, in collaboration with UEMOA's Observatory of Abnormal Practices and USAID's Agribusiness and trade promotion project, these initiatives produce a map for West African countries *(see below)* showing control posts (health, phytosanitary and zoosanitary) and obstacles (including illicit activities) to regional trade.

With the technical assistance of WATH, the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) also investigates road problems for five trade corridors within CILSS/ECOWAS territory as part of its Regional Support Programme (RSP) to improve market access financed by USAID Feed the Future. The reports do not cover Guinea, Liberia or Sierra Leone, but it was envisaged that CILSS would monitor livestock trade in the Bamako-Conakry corridor from February 2014.

Health corridor and cordon sanitaire

The term "health corridor" is rarely used. Health corridors have been established in connection with the HIV/AIDS epidemic. For example, a project began along the Abidjan-Lagos axis in 2000, with funding from the World Bank, with the aim of limiting the spread of AIDS along that axis by means of information, education and the distribution of condoms[56]. Another similar project in Mail (Project Corridor, with UN finance) run by the NGO JIGI, works to prevent the spread of AIDS along major road routes from Mali to Niger. Similar activities could be developed for other health issues such as Ebola.

Trade corridor and cordon sanitaire

The concept of *"commodity-based trade"* lies at the interface between cordon sanitaire and trade corridor. It is an example of a non-geographical sanitary standard proposed by certain parties interested in the environment and development (IIED, STEPS) as a less-limiting alternative in southern Africa to the current geographically-based approaches (disease-free zones) used to allow livestock products to be exported to countries free of foot and mouth disease. Commodity based trade is strongly based on risk assessment. Unlike other approaches that try to eliminate risk from a zone (disease-free zones) or value chain

54 http://continental1.org/trade-corridors
55 http://www.watradehub.com/fr
56 http://www.sante.gouv.tg/index.php?option=com_content&view=article&id=146:reunion-du-comite-directeur-de-lorganisation-du-corridor-abidjan-lagos-a-lome&catid=1:actualites-du-ministere&Itemid=2

The Borderless Alliance, officially launched in May 2012 with support from the USAID West Africa Trade Hub and its partners, provides an independent, sub-regional platform for leading producers, traders, transporters and financiers to propose and advocate for systemic and practical improvements to the movement of goods, transport, capital and services across West Africa.

Guided by international best practices, sound research and their Code of Ethics, Borderless Alliance members work together to promote change through dialogue and action – Extract from http://www.borderlesswa.com/what-borderless#sthash.o0JIHfqK.dpuf

(compartments), CBT assesses the risk inherent in a particular product and this is why it is of particular interest in the current situation *"CBT is dependent on applying risk management methods (of which there are many) to reliably counter specific biological hazards posed by individuals, commodities or products. Each specific commodity/product requires specific measures. For many commodities & products this can be achieved irrespective of whether dangerous infections occur in the area of production or not. Ideally risk mitigation incorporates a matrix of risk reduction mechanisms"*[57]. In addition, FAO's document *"value-chain management of animal diseases"* (FAO, 2011) contains some of the building blocks for constructing a corridor with humanitarian, health and trade objectives.

Humanitarian corridor

Developing trade corridors in the context of Ebola is also related to the idea that it is necessary to bring aid to the direct victims of the Ebola epidemic - those infected by the virus - as well as those indirectly affected by secondary effects of the virus such as movement restriction and food scarcity. In this respect, it borrows from the concept of humanitarian corridors: *"a humanitarian corridor is a space established in a zone devastated by war or catastrophe to allow the passage of humanitarian aid"*. Its function is to provide access to victims to bring them emergency aid. Creating and respecting humanitarian corridors was envisaged by UN resolutions but member states were under no obligation (Bouchet-Saulnier, 2000)[58]. Humanitarian corridors are established by organizations such as WFP or NGOs intervening in emergency situations (e.g. Médecins sans frontières).

57 http://web.up.ac.za/sitefiles/file/48/4153/Commodity%20based%20trade%20in%20context%20of%20rural%20development%20in%20Southern%20Africa-Presentation.pdf

58 www.msf.fr/sites/www.msf.fr/files/lacces_aux_victimes_principe_humanitaire_ou_slogan_politique.pdf

Annex 7. List of interviewed persons

Name	First Name	Institute	Function
BARRY	Mamadou Billo	IRAG. Guinea	Scientific director
BAH	Marianne	FAO Sierra Leone	Expert nutrition
BEAVOGUI	Famoï	IRAG. Guinea	General director
BEBAY	Charles	FAO Mali	FAO Ectad
BELLO	Nathan	Nestlé Côte d'Ivoire	Research & Development Cacao
MBOUP	Cheikh Mbacke	Nestlé Guinea	Research & Development
CISSE	Brahima	CILSS Burkina Faso	Expert market
COLY	Malang	WHO Senegal	EHA Focal Point
DEM	Halatou	Private Mali	Trader Fonio
DIALLO	Diawo	ENAE Macenta/ Min. de l'Enseigne-ment Technique et de la formation professionnelle Guinea	Director
DIALLO	Kourahoye	Fédération des paysans du Fouta Djallon (FPFD) Guinea	Trade expert
FAYE	Christophe Laba	OIM Senegal	
GAUTIER	Charles	Nestlé Côte d'Ivoire	Regional green coffee buyer
GUEYE	Mamadou	FAO Senegal	Expert, resilience
ROBERTS	Jo-Lind	OIM, Senegal	Head of office
KAMARA	Prince	Ministry of Agriculture, Forestry and Food Security (MAFFS), Sierra Leone	National Programme Coordinator of the Smallholder Commercialization Project
KALIVOGUI	Koikoi	Fédération des Eleveurs de Macenta Guinea	President
KEFING	Conde	FAO Guinea	Anthropologist
KOLIE	Alexandre	Caritas Nzérokoré Guinea	Caritas Nzérékoré
KOUAME	Pondo	Nestlé Côte d'Ivoire	Supply chain, cassava
LAMARANA	Souare Mamadou	FAO Guinea	Coordinator TCP and communications
MAHMOOD	Nazir	Centre de recherche de Rokupr Sierra Leone	Economist
MARTEL	Philippe	APDRA Guinea	Coordinator project
MOUILLEZ	Anne-Cécile	WFP Senegal	Regional Officer, Food security
MWESIGWA	David	FAO, Sierra Leone	Expert, Emergency
PETERS	Samuel	FAO Liberia	Agronomist
RENK	Simon	WFP Senegal	Market specialist
SONKO	Mamadou	FAO Senegal	Focal point FAO Senegal
TEDO	Mario	FAO Guinea	Expert Social mobilization
THOUILLOT	Floriane	Gret Guinea	Country Officer

Annex 8. Technical consultation meeting

Sustaining market chains and trade of agricultural products in the context of the EVD outbreak in West Africa

Technical consultation Meeting – 9 & 10 December 2014 Dakar, Senegal

PROGRAMME

Jour 1 - Tuesday 9 December		
Time	**Session 1 : Meeting opening Chair: Vincent Martin (FAO)**	**Intervenants**
08:30 - 08:40	Welcome - Registration	
08:40 - 08:50	Opening statements	Vincent Martin (FAO) Denis Depommier (Cirad)
08:50 - 09:20	Presentation of the Meeting : objectives, programme and presentation of participants	Patrick David (FAO)
	Session 2 : Overview of EVD impacts Chair : Arlène Alpha (Cirad)	
09:20 - 09:35	Impacts of the EVD outbreak on the agricultural sector, flow of agricultural products and food security	Brenda Lazarus (FEWS NET)
09:35 - 09:50	Discussions	
09:50 - 10:05	The use of a market chain approach for analysing the impacts of Ebola	Muriel Figuié (Cirad)
10:05 - 10:15	Questions and answers	
10:15 - 10:45	Pause	
	Session 3 : Analysis of the market chains Chair : Patrick David (FAO)	
10:45 - 11:00	Case studies : rice, potatoes, fruits and vegetables	Arlène Alpha (Cirad)
11:00 - 11:20	Discussions	
11:20 - 11:40	Case studies : cassava, palm oil, cocoa and animal products	Muriel Figuié (Cirad)
11:40 - 12:00	Discussions	
	Session 4 : Solutions for the market chains (group work) Chair : Patrick David (FAO)	
12:00 -12:10	Presentation of guidelines for group work	Arlène Alpha (Cirad)
12:10 - 12:30	Constitution of work groups : • Group 1 : rice, potatoes, cassava • Group 2 : palm oil, cocoa and animal products	Animateurs : Arlène Alpha (Cirad) Muriel Figuié (Cirad)
12:30 - 14:00	Lunch	
14:00 - 17:00	Group work	Facilitators and rapporteurs

Day 2 - Wednesday 10 Décember		
Time	**Session 4 : Solutions for market chains (group work)**	**Intervenants**
08:30 - 12:30	Group work	Facilitators and rapporteurs
12:30 - 14:00	Lunch	
	Session 5 : Conclusions of the group work Chair : Helen Roberts	
14:00 - 14:40	Presentation of the group work discussions	Rapporteurs
14:40 - 15:15	Discussions	
15:15 - 15:45	Pause	
15:45 - 16:00	Conclusions and recommandations	Muriel Figuié, Arlène Alpha (Cirad)
16:00 - 16:40	Discussions	
16:40 - 16:50	Evaluation	
	Session 6 : Meeting closure	
16:50 - 17:00	Closing remarks	Vincent Martin (FAO)

Participants list of the technical consultation meeting (Dakar, 9-10 Dec 2014)

Country	Name	Institute
Côte d'Ivoire	Ms Aline OGBA	Ministry of Commerce
Côte d'Ivoire	Mr Christophe Auguste DOUKA	Chamber of Commerce and Industry
Côte d'Ivoire	Mr Coulibaly DONIKPO	FAO Côte d'Ivoire
Guinea	Ms Nana GROVOGUI	Ministry of Commerce
Guinea	Mr Koikoi KALIVOGUI	Fédération des Eleveurs de la Préfecture de Macenta
Guinea	Mr Jesse BONWITT	Consultant FAO
Guinea	Mr MamadouKaba SOUARE	FAO-Guinea
Guinea Bissau	Mr Mama Samba EMBALO	National Association of Farmers of Guinea-Bissau
Guinea Bissau	Mr Rui Jorge Alves da FONSECA	FAO Guinea-Bissau
Liberia	Ms. Angie HOWARD	Private Entrepreneur
Mali	Mr Bourema KONE	IER/ECOFIL
Mali	Mr Cheick HAIDARA	CNOP
Sierra Leone	Mr Brima BANGURA	MAFFS
Sierra Leone	Mr Joseph BRIMA	FAO Sierra Leone
Senegal	Mr Ousmane MBAYE	Department of Interior Trade
Senegal	Mr AmadouAbdoul SY	Market Regulation Agency
Senegal	Mme Julie BRAYER MANKOR	Ambassy of France in Senegal
Senegal	Mr Alexandre SERON	Oxfam
Senegal	Mr SidyGuèye NIANG	Oxfam
Senegal	Mr Mitima DJUMA	Save the Children
Senegal	Mr Eric HAZARD	Save the Children
Senegal	Mr Malick FAYE	FAO-Senegal
Senegal	Mr Jan EIJKENAAR	ECHO
Senegal	Ms. Brenda LAZARUS	FEWS NET
Niger	Mr Mahamane Nasser RABIOU ALMADJIR	FEWS NET
Senegal	Mr Simon RENK	WFP
Senegal	Mr Matthieu TOCKERT	WFP
Senegal	Ms Aita GUEYE	CEDEAO /ARAA National Committee
UK	Ms Helen ROBERTS	Animal and Plant Health Agency (APHA)
USA	Ms Lindsey MCCRICKARD	Développement Alternative Inc. (DAI)
France	Ms Muriel FIGUIÉ	Cirad
Burkina Faso	Ms Arlène ALPHA	Cirad
Senegal	Mr Michael NGONGI	FAO
Senegal	Mr Vincent MARTIN	FAO REOWA
Senegal	Mr Patrick DAVID	FAO REOWA
Senegal	Mr Pape Boubacar SOUMARE	FAO REOWA
Senegal	Ms Oriane TUROT	FAO REOWA

Country	Name	Institute
Senegal	Mr Julien GAVELLE	FAO REOWA
Ghana	Mr Jacques CONFORTI	FAO RAF
Senegal	Mr Alexandre SERON	OXFAM
Senegal	Mr Oumar DIOUF	FAO
Senegal	Mr Youssouf DIEME	CCIAD
Senegal	Mr Philipp KONE	FAO REOWA
Guinea	Mr Sear dam BA	OXFAM AMERICA

Vincent Martin, FAO Representative in Senegal
Head of the Sub-Regional Resilience Team for West Africa/Sahel (REOWA)
15, rue Calmette x rue Amadou Assane Ndoye
BP N° 3300 | Dakar, Senegal
Phone: (+221) 33 889 16 59
www.fao.org/emergencies/crisis/ebola/en/

ISBN 978-92-5-109223-1
9 789251 092231
I5641E/1/05.16